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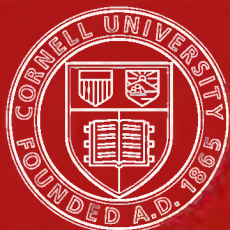
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R E P O R T

ON THE

LAWS AND ORDONNANCES IN FORCE IN FRANCE

FOR THE

REGULATION OF NOXIOUS TRADES
AND OCCUPATIONS ;

BY

DR. WALLER LEWIS,

MEDICAL OFFICER TO THE GENERAL POST OFFICE.

Presented to both Houses of Parliament by Command of Her Majesty.



L O N D O N :

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PRINTERS TO THE QUEEN'S MOST EXCELLENT MAJESTY.

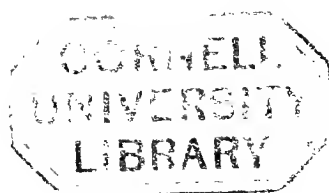
FOR HER MAJESTY'S STATIONERY OFFICE.

1855.

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P R E F A C E.

General Post Office, St. Martin's-le-Grand,
July 1855.

SIR,

IN compliance with the instructions of Viscount Palmerston that I would make a concise digest of the laws and ordonnances in force in France for the better regulation of noxious trades and occupations, I have the honour of transmitting herewith the following series of reports :—

The works that I have more especially consulted are, the “*Collection Officielle des Ordonnances de Police*,” drawn up by M. Gabriel Delessert, formerly Prefect of Police ; the “*Annales d'Hygiène*,” the “*Traité d'Hygiène Publique et Privée*,” by Dr. Michel Lévy ; the “*Dictionnaire d'Hygiène Publique*,” by Dr. Ambroise Tardieu ; the “*Dictionnaire des Altérations et Falsifications des Substances Alimentaires*,” by A. Chevallier ; together with numerous Reports of various Provincial Councils of Health, and other works, of which copies were transmitted by the French Minister for Foreign Affairs to the Earl of Clarendon, for the use of the late General Board of Health.

The same instructions having authorized me to visit Paris to observe the practical operation of the laws in question, I have done so, and have given the results of my observations in various reports.

I would beg to observe that through the kind offices of M. Billault, the Minister of the Interior, and of M. Collet-Meygret, the Directeur Général de Santé Publique, I was enabled to inspect all the public and private industrial establishments that the time at my disposal admitted of.

Many of these are models of what such manufactories should be, more particularly the White Lead Manufactory of M. Besançon and the Tannery of M. Leven, which leave nothing to be desired as regards the health and comfort of the workmen.

New and improved processes have been introduced in these and other factories, which supersede many of the old, objectionable, and unhealthy methods still all but universally employed in this country. The absolute disuse of the fermented dung of certain animals to de-lime the hides in tanning, is one among various instances that I might adduce in proof of this.

As far as I have been able to form an opinion, the system of keeping an active supervision by means of a department of the Police (*Hygiène Publique et Salubrité*) over the noxious trades and occupations likely to interfere with the public health, appears to be very successful. While the interest of the workman is strictly cared for, the masters themselves do not complain of any undue or harsh interference by the authorities.

To M. Trebuchet, the very intelligent chief of this service, who is the author of many of the most enlightened ordonnances that the French Government has promulgated, I am much indebted for his assistance.

I have the honour to remain,

Sir,

Your most obedient Servant,

WALLER LEWIS,

Medical Officer to the Post Office.

Sir George Grey, Bart.,
Secretary of State, Home Department.

REPORTS.

On the classification of unwholesome occupations, and the causes of their being so classed.

INDUSTRIAL establishments are frequently inconvenient or unhealthy to the neighbourhood; the odours they give off, the vapours or the smoke they emit, may render the surrounding space, within a certain radius, very disagreeable, or even unfit for habitation.

The administration, therefore, has thought it necessary to take measures for satisfying the legitimate complaints generally given rise to by such establishments as fix themselves in the midst or on the borders of centres of population.

Nevertheless, it is but a few years since any precise and protective legislation has existed on this subject. It is true that from the fifteenth century, namely in 1486, a royal proclamation ordered the suppression of potteries in Paris, on the complaint of the neighbourhood; and in 1567, certain industrial employments, as those of chiffonniers, knackers, and tanners, were driven from the interiors of large towns. Still, up to the commencement of the present century, such establishments were the objects of no special regulations.

However, by an ordonnance of the 12th February 1806, the prefect of police prohibited the establishment in Paris of any workshop, manufactory, or laboratory which could compromise health or occasion a fire, without there being previously made, at the prefecture of police, a statement of the nature of the materials intended to be prepared, and the works proposed to be carried on. These declarations were to be followed by visits and inquests *de commodo et incommodo*.

But these regulations were badly carried into execution. The Minister of the Interior therefore consulted the Academy of Sciences on the general measures necessary for the regulation of manufactures in the interest of public health. The report of Guyton, Morveau, Chaptal, and G. Cuvier, served as the basis of the decree of 15th October 1810, and of the ordonnance of the 14th January 1815, which two regulate all these subjects at the present day.

All dangerous, insalubrious, or inconvenient establishments are divided into three classes, and before they are permitted to be carried on, certain authorizations and formalities are indispensable. Councils of Health are at the present time called upon to give their advice on the formation of such establishments as are classed.

Factories in the First Class.

The establishments of the *first class* are those that must be kept at a distance from private habitations; but it is not necessary that they be prohibited from the outskirts of a town. To the authorities belong the duty of examining if the isolation is sufficient, having regard to the importance of the works, to the nature and configuration of the soil, and to the importance of the surrounding dwellings. The demand for authority (*i. e.* for permission to establish) must be addressed to the prefect of the department, and to the prefect of police for the jurisdiction of the prefecture of the Seine. The demand must be accompanied by two plans, one indicating the connexions of the proposed works with the neighbouring lands and habitations, the other showing its internal arrangements. The demand for authority is placarded in all the communes within a radius of five kilometres (three miles), and must remain exposed during one entire month. Besides this, the mayor of the commune where the works are to be erected must hold an inquiry (*une enquête*) *de commodo et incommodo* among the nearest neighbours. This inquiry, drawn up by the mayors, consists of evidence gathered by themselves personally, or communicated by those interested in the matter: it constitutes one of the most important formalities preceding the authorization.

All the documents are transmitted to the prefect, who submits them to the Council of Health, and afterwards to the Council of Prefecture, if there is any opposition. When these various formalities have been gone through, the prefect sends the whole of the documents to the Minister of Commerce, with his recommendations, whatever they may be; when, after submitting the proposal to the advice of the Council of State, the minister proposes to the chief of the Government an order of refusal or authorization, which the prefect is charged with executing.

Factories in the Second Class.

The establishments of the *second class* are those which do not rigorously require their being kept at a distance from habitations, but which it is important not to allow until assurance has been obtained that the operations proposed to be carried on in them are executed so as not to be a nuisance to the neighbourhood, and not to cause damage. It is the prefects, who, after consultation with the Councils of Health, authorize the establishments of the second class.

Factories in the Third Class.

The *third class* works are such as may remain without inconvenience near dwellings, but which should be subject to the surveillance of the police. These establishments are authorized by the sub-prefects in the arrondissements of the sub-prefectures, by the prefects in the arrondissements of the departments, and by the prefect of police in his department.

These regulations have no retro-active effect. All the establishments in existence at the time of the promulgation thereof have continued being freely carried on, and may even be disposed of without the purchaser being called upon to obtain a new authorization, unless they are removed to another locality, or unless their proprietors wish to make some change in the conditions under which they were originally licensed.

The prefects have authority to suspend the formation of *new establishments*, *i. e.* such as proposing to deal with employments as yet unknown, have not yet been comprised in any class.

The following lists comprehend the most important establishments classed from 1810 up to the present time.

FIRST CLASS.

Description of the unwholesome, dangerous, or inconvenient Establishments.	Summary of their inconveniences.
Abattoirs, <i>public</i> and <i>communal</i> , for all towns.	Bad odour.
Acid, nitric. -	Much smoke, and acid fumes.
Acid, pyroligneous (when the gases are given off in the atmosphere without being consumed).	Ditto.
Acid, sulphuric.	Fumes disagreeable, unhealthy, and hurtful to vegetation.
Refining of gold or silver by sulphuric acid, when the disengaged gases are liberated.	Insalubrious gases.
Refinement of metals by means of the cupel or reverberating furnace.	Smoke and noxious vapours, also injurious to vegetation.
Matches, manufacture of, prepared with detonating or fulminating materials. This comprises chemical matches.	The same dangers as fulminating powders.
Starch, manufactures of, except such as is made without fermentation, and are provided with free means of escape for the waters.	Very disagreeable odours.
Resin. - -	Danger of fire, and disagreeable odours.
Artificial fire, manufactures of. -	Danger of fire, and explosions.
Prussian blue, manufacture of, when the smoke and gases are not consumed.	Odour unhealthy and disagreeable.
Prussian blue (depôts of blood of animals intended for the fabrication of).	Disagreeable smell, particularly when the blood preserved is not in a dried state.

Description of the unwholesome, dangerous, or inconvenient Establishments.	Summary of their inconveniences.
Mud and filth, accumulations of. -	Odour very disagreeable and unwholesome.
Gut-spinning. - -	Ditto.
Calcination of bones, when the smoke is not consumed.	Very disagreeable smell of burnt animal matter, carried a great distance.
Pearl ashes, manufacture of, when the smoke is unconsumed.	Disagreeable odour.
Animal débris (depôts of, and where animal matter is prepared by maceration, or dried for other manufactures).	Ditto.
Hemp, manufacture of. -	Very unwholesome exhalations.
Animal charcoal, when the smoke is unconsumed.	Disagreeable odours of burnt animal matter, conveyed to a great distance.
Coke and charcoal, manufacture of.	Smoke and disagreeable odours.
Chloride of lime, wholesale manufacture of.	Disagreeable odours.
Alkaline chlorides.	Ditto.
Glue, manufacture of.	Ditto.
Combustion of sea plants. -	Ditto, carried to a long distance, and injurious to vegetable life.
Strings for instruments, manufacture of.	Not disagreeable, if freely provided for the easy conveyance away of the waste waters.
Cotton cloth, manufacture of. -	Bad smells, and danger of fire.
Crystal, manufacture of. - -	Smoke, and danger of fire.
Varnished leather, manufacture of. -	Bad smells, and danger of fire.
Enamel, manufacture of.	Smoke.
Printers' ink, manufacture of. -	Very disagreeable smells, and danger of fire.
Manure, depôts and manufacture of. -	Disagreeable and unwholesome odours.
Knackers' establishments. - -	Very disagreeable smells.
Ether, manufacture of, and depôts of ether, when they contain more than five gallons.	Explosion, and danger of fire.
Fusees, manufacture of. - -	Explosion and fire.
Hat varnish, manufacture of. - -	Fire, and disagreeable odours.

Description of the unwholesome, dangerous, or inconvenient Establishments.	Summary of their inconveniences.
Furnaces, large. -	Thick smoke, and danger of fire.
Fulminating mercury and similar powders.	Explosion, and danger of fire.
Pitch, manufacture of. - -	Very bad smells, and danger of fire.
Fat melting over open fires. - -	Ditto.
Linseed oil, boiling of. - -	Ditto.
Oil of ox feet, manufacture of. -	Bad odour.
Fish oil, manufacture of. - -	Ditto, and danger of fire.
Oil of turpentine, distillation of.	Ditto.
Litharge, manufacture of. - -	Dangerous exhalations.
Menageries. - - -	Danger from the animals escaping from the cages.
Animal black, manufacture and depôts of.	Very disagreeable and unwholesome effluvia.
Ivory black, manufacture of, when the smoke is unconsumed.	Disagreeable odours carried to a great distance.
Archil, manufacture of. - -	Disagreeable smells.
Piggeries. - - -	Disagreeable effluvia and noises.
Poudrette (artificial manure). - -	Bad smells.
Prussian red, manufacture of, in open vessels.	Emanations disagreeable and injurious to vegetation, when made with sulphate of iron.
Sal ammoniac, manufacture of.	Disagreeable smells.
Sulphur, flowers of, manufacture of.	Great danger of fire, and disagreeable odours.
Sulphur, distillation of.	Ditto.
Tallow melting. - - -	Bad odours; danger of fire.
Sulphate of ammonia, manufacture of, from animal matter.	Disagreeable smells carried to a distance.
Sulphate of copper, manufacture of, by means of sulphur and wirework.	Exhalations disagreeable and injurious to vegetation.
Sulphate of soda, manufacture of, in open vessels.	Ditto.
Metallic sulphates, roasting of, in the open air.	Ditto.
Tobacco, combustion of the veins of, in open air.	Disagreeable odour.
Oil-silk, manufacture of. - - -	Danger of fire, and bad smells.
Turpentine, extraction of, in the large way.	Unwholesome smells, and danger of fire.
Oiled cloths, manufacture of. - -	Ditto.

Description of the unwholesome, dangerous, or inconvenient Establishments.	Summary of their inconveniences.
Tripe dressing.	Bad smells, and good drainage required.
Slaughter-houses in towns with a population exceeding 10,000.	Danger of animals escaping, and bad smells.
Urates, manufacture of. - - -	Disagreeable odours.
Glass works. - - - -	Great smoke, and danger of fire.

ESTABLISHMENTS of SECOND CLASS.

Absinthe or Wormwood, distillery of. Acid muriatic, manufacture of, in closed vessels.	Danger of fire. Disagreeable smell, and inconvenient when the vessels leak.
Acid muriatic oxygenated. -	Ditto.
Acid nitric, manufacture of, by the decomposition of saltpetre by means of sulphuric acid in Wolf's apparatus.	Ditto.
Acid, pyroligneous, manufacture of, when the gases are consumed.	Slight smoke, and empyreumatic odour.
Acid, pyroligneous, all the combinations of, with iron, lead, or soda.	Ditto.
Steel, manufacture of. - - -	Smoke, and danger of fire.
Refining of gold or silver by sulphuric acid, when the gases are condensed.	Very few inconveniences when the apparatus is in good condition.
Starch, manufacture of, when made without the substances undergoing fermentation.	Bad smells.
Bitumen, manufacture of. - - -	Danger of fire.
Asphalte, manufacture of. - - -	Ditto.
White of whale (spermaceti), refining	Slight inconveniences.
Bleaching of tissues of wool or silk by means of gas or sulphurous acid.	Disagreeable effluvia.
Bleaching of hemp, cotton, or linen by chlorine.	Ditto.
White lead, manufacture of. -	Inconvenience only to the health of the workmen.
Prussian blue, manufacture of, when the smoke and hydrogen gases are consumed.	But few inconveniences when the apparatus is perfect, which, however, is rarely the case.

Description of the unwholesome, dangerous, or inconvenient Establishments.	Summary of their inconveniences.
Bricks and tiles, manufacture of. -	A large quantity of smoke, given off on the kilns being first lighted.
Laundries. - - - -	Effluvia disagreeable and unwholesome.
Calcination of bones when the smoke is consumed.	Always bad smells, even when the apparatus in the best order.
Caoutchouc. Where this is dissolved in turpentine to apply to tissues. (Provisionally.)	
Charcoal burning in the open air. -	Smells and smoke very disagreeable, and extending to a distance.
Candle making. - - -	Some danger of fire, slight smell.
Hats, manufacture of. - -	Disagreeable odour, and black dust carried to a distance.
Animal charcoal, when the smoke is consumed.	Bad smell always present.
Lime pits. - - - -	Much smoke.
Chlorine gas. - - - -	Smell disagreeable and annoying.
Chloride of lime, when the manufacture is under 600 lbs. per day, at the most.	Ditto.
Alkaline chlorides, when these products are used in the establishments in which they are made.	Ditto, but the inconveniences rather less.
Chromate of potass, manufacture of.	Disengagement of nitrous gas.
Sealing wax, manufacture of. -	Some danger of fire.
Glue from rabbit skins, manufacture of.	Bad odour.
Fresh hides, depôts of. - - -	Odour disagreeable and noxious.
Copper, melting of. - - - -	Smoke, and noxious emanations.
Brandy, distilleries of. - -	Danger of fire.
Potteries. - - -	Smoke.
Tarred felt, manufacture of.	Bad smells, and danger of fire.
Metal foundries, wholesale. -	Noxious vapours, especially when lead, zinc, copper, &c., are melted.

Description of the unwholesome, dangerous, or inconvenient Establishments.	Summary of their inconveniences.
Forges, large. -	Much smoke, and danger of fire. Bad smells.
Gold and silver lace, burning in a large way.	
Gas works and gasometers.	Odours noxious, smoke, and danger of fire and explosion.
Gin distilleries.	Danger of fire.
Herrings, salting. -	Bad odours.
Oil of turpentine and other essential oils, depôts of.	Very great danger of fire, must be isolated from all dwelling-houses.
Purification of oils by sulphuric acid. -	Danger of fire, and bad smells.
Bacon, places for smoking. -	Bad odours, and smoke.
Washing and drying sponges, establishments for.	Bad odours, produced by the escaping waters.
Liqueurs, fabrication of. -	Danger of fire.
Morocco leather, manufacture of.	Bad odours.
Machines and boilers at high pressure, of more than two atmospheres.	Smoke, and danger of fire and explosion.
Machines and boilers working at low pressure, consuming or not their own smoke.	Ditto.
Plaster mills.	Much noise when done by the dry system ; there is injury to the health of the workmen, and slighter mischief even to the neighbourhood.
Flour mills in towns. -	Noise and dust.
Black from soot, manufacture of. -	Danger of fire.
Ivory black, manufacture of, where the smoke is consumed.	Smells bad.
Mineral black.	Bad odours.
Refining gold and silver by furnace.	Unwholesome vapours.
Archil, manufacture of, in closed vessels, only employing ammonia, no salts of urea.	Ditto.
Bone, bleachings for fans and buttons.	Few inconveniences.
Oxyde of zinc. -	Much smoke and dust.
Paper, manufacture of. -	Danger of fire.
Parchment, manufacture of. -	Disagreeable odour.
Phosphorus, manufacture of. -	Danger of fire.
Smoking pipes, manufacture of.	Smoke.
Porcelain, manufacture of. -	Ditto.
Prussian red, manufacture of, in closed vessels.	Slight noxious vapours, and smoke.

Description of the unwholesome, dangerous, or inconvenient Establishments.	Summary of their inconveniences.
Salting fish, workshops for.	- Very disagreeable odours.
Salt fish, depôts of.	- Disagreeable odour.
Dried cod, depôts of.	- Ditto.
Sulphur, fusion of.	- Great danger of fire, and bad smell.
Sugar, refineries of.	- Smoke, and bad odours.
Sugar, manufacture of.	- Ditto.
Tallow, melting of, in water bath.	- Some danger of fire.
Sulphate of soda, manufacture of, in closed vessels.	- Slight odour, and smoke.
Sulphate of iron and zinc, fabrication of, with sulphuric acid and the metals.	- Odour slightly disagreeable.
Metallic sulphurets, roasting of.	- Ditto.
Tobacco, manufacture of.	- Odour very disagreeable.
Tanning.	- Bad odours.
Bleaching by oxygenated muriatic acid.	- Ditto.

ESTABLISHMENTS OF THIRD CLASS.

Acetate of lead, manufacture of.	- Inconveniences chiefly to the health of the artisans.
Acetic acid, manufacture of.	- Few inconveniences.
Tartaric acid, manufacture of.	- Slight odours.
Ammonia, manufacture of, wholesale, and the salts of ammonia.	- Disagreeable odours.
Artificial slates and mastics of various kinds, manufacture of.	- Ditto, and danger of fire.
Whalebone, working of	- Noise, and fætid odour, noxious and disagreeable.
Beating wool or hair constantly in large quantities.	- Ditto.
Gold and silver beaters.	- Noise.
Bleaching hemp, linen, or cotton, by alkaline chlorides.	- Slight inconveniences.
Spanish white, manufacture of.	- Ditto.
Artificial borax, manufacture of.	- Ditto.
Borax, refining.	- Ditto.
Candles from spermaceti.	- Danger of fire.
Metallic buttons, manufacture of.	- Noise.
Breweries.	- Much smoke, and a little smell.
Brick kilns, with only one furnace in the open air.	- Much smoke at the commencement.

Description of the unwholesome, dangerous, or inconvenient Establishments.	Summary of their inconveniences.
Phosphoric matches. - - - Laundries.	Danger of fire. Soap and water decompose.
Camphor, preparation and refinement of.	Strong odours, and danger of fire.
Type founding.	Slight inconvenience.
Burnt sugar, manufacture of, wholesale (caramel).	Danger of fire, and bad smell.
Cinder washing.	Slight inconvenience.
Chicory, manufacture of. -	Ditto.
Firewood, wharfs or yards of, in towns.	Danger of fire, requiring the surveillance of police.
Charcoal, depôts of, in towns. -	Ditto.
Limekilns, only working one month in the year.	Great smoke.
Chromate of lead, manufacture of. -	Slight inconvenience.
Wax melting. - -	Danger of fire.
Horn, shaving of. - - -	Slight bad smells.
Dyers. -	Ditto.
Gilding on metals. -	Danger to the health of workmen.
Writing ink, manufacture of. -	Slight inconvenience.
Fattening cattle, large establishments for.	Bad odours and inconveniences.
Tinfoil, manufacture of. -	Slight inconvenience.
Potatoe starch, manufacture of. -	Bad odours from the watters when they are kept.
Tin plate, manufacture of. -	Slight inconvenience.
Melters by means of crucible.	Slight smoke.
Cheese, depôts of. - -	Very bad odours.
Hydrogen gas, small apparatus for making.	Smells, danger of explosion and fire.
Gasometers, not attached to gas works, and holding above 10 cubic metres.	Ditto.
Gelatine from bones, manufacture of, by acids and boiling.	Smells bad, when the materials are not fresh.
Looking-glass makers. - -	Dangers for the workmen only.
Lake colours, manufacture of.	Slight.
Wool washing, establishments for. -	Should be placed on banks of river or running stream.
Glazing skins. - - -	Slight.
Oil mills. - - -	Odour, and danger of fire.
Yellow ochre, calcination of. -	Some smoke.
Papers, painted and marble, manufacture of.	Danger of fire.

Description of the unwholesome, dangerous, or inconvenient Establishments.	Summary of their inconveniences.
Shot factories. - - -	Slight.
Plumbers, and makers of fountains. -	Ditto.
Potass, manufacture of. -	Ditto.
Sabots, establishments for smoking.	Smoke.
Saltpetre, manufacture of. -	Smoke and fire.
Soap boiling. -	Bad smells, smoke, and disagreeables.
Salt refining. - - -	Slight.
Dry subcarbonate of soda, manufacture of.	Slight smoke.
Soda, manufacture of, by decomposition of the sulphate.	Smoke.
Sulphate of copper, by means of sulphuric acid, and oxide or carbonate of copper.	Slight.
Sulphate of potass, refining. - -	Ditto.
Sulphate of iron and alum. - -	Smoke and smells.
Tartar, refining. -	Slight.
Wire-drawing. -	Noise and fire.
Slaughter-houses in communes containing fewer than 10,000 inhabitants.	Bad smells.
Cow-keepers in towns with more than 5,000 souls.	Ditto.
Verdigris, manufacture of. -	Slight.
Meat, preserving. - -	Ditto.
Vinegar, manufacture of. - -	Ditto.

On the effects on health of various Professions and Occupations.

THE professions, if we except those called “liberal,” are recruited almost invariably from among the middling and lower classes. It follows, that the influence of many occupations is engraved in permanent characters on the organization of certain classes of society, and gives rise to hereditary modifications, which combine with those of race, climate, &c. Such is the predominance of the nervous system among persons devoted to literary pursuits; the disposition to pulmonary consumption transmitted to their children by parents whom their occupations expose to this disease. Thus M. Lombard, of Genoa, has found that in a thousand deaths, consumption had furnished the following proportions:—

Occupations—

With vegetable and mineral emanations	- 176
With various dusts - - - -	- 145
With sedentary life - - - -	- 140

Occupations—*continued*.

With workshop life	-	-	-	138
With hot and dry air	-	-	-	127
With stooping posture	-	-	-	122
With sudden movements of arms	-	-	-	116
With muscular exercise and active life	-	-	-	89
With exercise of the voice	-	-	-	75
Living in the open air	-	-	-	73
With animal emanations	-	-	-	60
With watery vapour	-	-	-	53

In manufactures, the majority of workmen are affected with scrofula; this scourge marks the children, the youths with its scars, its swellings, its infirmities, its hideous deformities; it attacks more especially the weavers and their families.

The populations of the manufacturing towns are weak and diminutive; bent over their looms and living in shade, they become etiolated like plants. Since the great increase of the manufactures in the department of the Haut-Rhin (from 1810 to 1823), the average height of the people has not increased in the same proportion as in the neighbouring departments. Official documents prove that the population of the manufacturing towns is less vigorous than that of the rural districts. Everything tends to exhaust it; placed as auxiliaries by the side of the devouring activity of steam or a fall of water which never reposes, it carries to its utmost limits the development of its forces; in the large assemblages of all ages and sexes, the passions are lighted up, the contagion of vice acts with a kind of furor, and the excesses of debauchery accelerate the deterioration of the strongest constitutions. In this manner the sources of reproduction become impoverished and corrupt: conceived in misery and libertinage, the weak scions of this bastardised population pass in their turns under the empire of the same causes of physical and moral degradation: it is in fact a circle without end, in which health and life go on exhausting themselves continually.

Sexes.

The comparative weakness of women exposes them to more dangers in the works they execute in common with men, and renders them more liable to the attacks of the noxious effects of each calling: they furnish, indeed, in the occupations exercised by the two sexes more diseases and more maladies than the males. This result is partly due to the difference of their earnings, which are less than those of the men, because they have less strength to spend. Up to the age of 15 or 16 the wages differ little for the two sexes; but from that time, the earnings of the women are much inferior to those of the men, and after the age of twenty, the woman obtains in general but half the amount that the man does. Now the salary is the nourishment, the clothing, the lodging; the workwoman is therefore ill fed, ill clothed, ill lodged; she languishes in narrow circumstances, often in misery, which finishes the destruction of her constitution.

And as the deprivation of enjoyments does not extinguish the taste or the desire for them, as want is a bad adviser, and quickly triumphs over the weak resistance of a conscience without religious light to guide it, first debauchery, then excesses of all kinds come in to consummate the work of destruction commenced by distress. Certain occupations have a more rapid decline to evil: needlewomen, dressmakers, embroideresses, modistes, &c., furnish always more of the class of public women than women employed in brush-making, menders of old clothes, &c. The separation of the sexes in the workshops is a measure imperiously demanded for the moralisation of the working population.

Age.

On the 22d of March 1841 a law came into operation, of which the following are the principal provisions.

On account of the danger and insalubrity, children shall not be employed under the age of 16 years in certain establishments, to be determined by the Government. From 8 to 12 years of age, they shall not work more than 8 hours a day, these hours to be divided by a repose; from 12 to 16 years of age, 12 hours of work per day, divided by times of rest, and comprised between 5 a.m. and 8 p.m. In the works of urgency which take place during night, children can only be employed if they are above 12 years of age, and during 8 hours only in the 24.

Health.

The various employments divide themselves under this head into two classes, depending upon whether they are carried on in the open air, or in confined air. Consumption is twice as frequent in the first case as in the second. The latter group comprises professions carried on in vast spaces well aerated, others which confine the workmen in narrow close localities. M. Lombard finds phthisis in a larger proportion among the latter than among the former. Thus the workshop well closed, where are arranged a certain number of workmen; the schools where studious youths are congregated; the closet where the professor passes long hours in meditation, act all in a similar manner; all these temporary habitations sin by their dimensions, by the non-renewing of the air, by the elevation of the temperature, and the hygrometric saturation of the atmosphere, &c. In a great number of occupations the atmosphere is loaded with vapours or dusts, which exert a direct action on the lung, and may give rise to general phenomena. The matters in solution in the air are purely aqueous, animal, vegetable, or mineral; they will be discussed farther on.

As to the dusts, independently of the specific effects they produce by their nature, they exercise a direct influence on the lung, which is in the ratio of the volume, the weight, and the consistence of their molecules.

The inhalation of coarse particles is less dangerous than that of dusts finely divided, which penetrate more easily into the last ramifications of the air cells. The researches of Messrs. Benoiston and Lombard have proved that sculptors, masons, plasterers, exca-

vators, hatters, brushmakers, harness-makers, mattress-makers, &c., furnish fewer consumptive patients than millers, wig-makers, paviors, sweepers of streets, charcoal-dealers, bakers, cutlers, chimney-sweepers, polishers, &c.

Dusts from hard substances cause a much greater number of consumptive cases than dusts from soft bodies, or of ordinary hardness. The specific gravity of the dusts does not affect in any marked manner the production of phthisis.

Under the consideration of their origin, mineral dusts are the most noxious to the lungs; then follow animal dusts, and lastly vegetable. The private habitations of workmen leave much to be desired; they live in narrow, dirty, obscure streets; too frequently only one room, encumbered with beds, tools, chairs, serves at the same time as workshop, kitchen, and bedroom. M. Villemé, however, observes that the habitations of the labouring classes are generally beginning to improve; one sees many that are healthily and conveniently constructed.

Generally those workmen, whose conduct and manners are blameable, live in the same streets and the same houses, in the most filthy and most unwholesome parts of the town, whilst the good and meritorious artisans seek different quarters, and make pecuniary sacrifices to establish their separation from the former class. The rendering healthy the habitations of the working-classes is one of the first requirements of public health; *it is the duty of those in authority to attempt it*. The commodious settling of working families would not be a fruitless enterprise; it would implant in them a love of home, a taste for domestic life; it would strengthen the ties of family, would inspire them with sentiments of forethought and economy by the possession of the first element of comfort.

Dress.

Labourers, although better dressed than formerly, have still much to desire and to do for their cleanliness, for their vestimentary protection; they do not change their linen sufficiently often; they keep on their bodies clothes impregnated with sweat, they put them on badly, or do not cover themselves completely; from thence arise a host of diseases that they attribute to the action of cold, without thinking that it is in their power to annul this cause by dressing more properly.

Smelters, blacksmiths, glass-blowers, furnace-heaters, stokers, bakers, &c., who are plunged in a burning atmosphere, take no precaution whatever on quitting their work; those who execute works requiring great strength, cool themselves with the same imprudence.

Greater care paid to the clothing, and its more fit appropriation to the wants of various professions, would reduce the number of severe diseases and the mortality thence ensuing.

Various Senses injured.

Certain employments fatigue particularly one or other of the senses. Those which are concerned with very shining materials,

as metals, looking-glasses, &c., injure the sight ; it is of importance to interpose between the artificial light and the object worked at a piece of stretched canvas, an oiled paper, a gauge, or some other screen which intercepts the direct luminous rays, and will only permit a diffused light to pass.

The smallness of the objects, and the intensity of direct or reflected light, always end in compromising the integrity of the vision. Many astronomers, who have applied themselves to the observation of the sun, as Galileo, have become totally blind ; opticians who daily examine and test spectacles and microscopes, engravers, watchmakers, compositors, &c., are threatened with amblyopia and amaurosis ; night-work fatigues as much by the smallness of the print or the writing, as by the whiteness of the paper reflecting the light of the lamps ; workwomen in linen, lace, &c., are forced by the same cause to have early recourse to the use of spectacles.

It is not exactly known whether the trades in which hammers are used, and the sojourn in workshops in which noisy engines ply, cause a weakening of the organ of hearing ; but this appears to be very probable, according to the observation of Percy on the effect of detonations of artillery, which causes many gunners to experience rupture of the tympanum.

*Extracts from the Ordonnances concerning Public
Abattoirs in Paris.*

(Condensed from the French Laws and Ordonnances de Police, from
1800 to 1850.)

ABATTOIRS. — Slaughter-houses.

BY a decree made by Napoleon I., dated February 9th, 1810, it was determined to erect five abattoirs at the expense of the city of Paris, as the following extract from the *Moniteur* of February 10th shows:—

“ A decree of February 9th, 1810, made by His Majesty, in His
“ Palace of the Tuilleries, contains the following provisions:—

“ “ There shall be established five abattoirs at Paris, three on the
“ ‘ right bank of the river, one of which shall contain 24 slaughter-
“ ‘ houses, the second 18, and the third 12. The two abattoirs on
“ ‘ the left bank shall each contain 18 slaughter-houses.’ ”

This plan was subsequently very much altered and extended.

The following table gives a summary of the relative sizes and capacities of each of the five abattoirs:—

Name of Abattoir.		Acres.	No. and Area of Slaughter-houses.	
			sq. yds.	
Montmartre	- -	$8\frac{3}{4}$	64 - -	3,872
Grenelle -	- -	$7\frac{1}{2}$	48 - -	2,904
Du Roule -	-	$5\frac{3}{4}$	32	1,936
Menilmontant -	-	$10\frac{1}{4}$	64	3,872
Villejuif	-	$5\frac{1}{2}$	32 -	1,936

Each of these is about $1\frac{3}{4}$ miles from the centre of the city, but within the barriers, as the small plan attached will show.

These five abattoirs were completed in the year 1818.

The following are the principal clauses relating to the public health:—

7. The inspector of police will attest the fact of the *natural* death of any beast in the abattoirs. The inspectors of the butchers will send the animals so dying to the menagerie, as well as all other meats (in whatever place they are found) that they consider unfit for human consumption.

48. All the animals intended for the butchers' trade of Paris, without exception, can only be slaughtered and dressed in one of the five public abattoirs.

52. The butchers must provide themselves with gambrels, blocks, tubs, buckets, wheel-barrows, and all other necessary tools and instruments, which they must keep clean and in good condition.

64. Admission into the oxen sheds during the night with lights is prohibited, unless they are covered.

67. Butchers may kill at any hour of the day or night.

68. Butchers who slaughter at night are ordered to declare the same to the superintendent of police.

69. It is strictly prohibited to leave the doors open during the slaughtering.

70. The butchers are enjoined to cause their scalding-houses to be washed after killing.

71. They are prohibited from leaving in the scalding-houses any tallow, grease, dung, intestines, or skins of any kind.

72. The butchers must remove the dung from the oxen's stalls every month, or as frequently as requested by the police, and the liquids every day.

73. Accumulations of hair and skulls are prohibited.

75. No slaughtering of oxen, cows, or calves is permitted in the courtyards or paved yards.

76. The oxen and cows, before being killed, must be securely fastened to a ring in the wall of each slaughtering room.

The butchers are responsible for any accident arising from neglect of this article.

77. The bullocks and oxen known to be dangerous must be driven to the abattoirs and scalding-rooms in chains, or coupled together together.

78. The calves and sheep must be bled in tubs, so that the blood shall not find its way into the channels which lead to the drains.

79. The butchers to cause the walls, floors, and doors of the scalding-houses to be frequently scraped and washed.

80. They must not deposit the skins and hides of the beasts in the streets or paved yards.

92. The persons employed in removing the blood must remain in the work yard during the killing.

93. They are prohibited from encumbering the passages and paddocks with their casks, either full or empty. They must place them where directed by the police.

94. Every day, after work, they must roll the casks full into the appointed places.

These must not remain in the abattoirs more than 24 hours.

95. The contractors for the liquids must remove them completely each day and hour prescribed.

96. The fats resulting from the slaughtering can be melted at no other place than the abattoirs.

132. The entrails of all the animals slaughtered in each abattoir to be dressed and prepared in the tripe establishment of each abattoir before they are removed.

Those entrails that are intended for the exterior of Paris are excepted.

141. Butchers, melters, and tripe-boilers, to employ only covered vehicles for the carriage of their goods.

155. Any butcher's boy selling calves found in the inside of cows that he has killed, and who does not immediately declare the fact to the superintendent of police, in order that these unwholesome meats may be cut in pieces, to be thrown into the common receptacle, shall be tried and punished according to law.

261. The larger entrails only to be sold after having undergone certain preparations.

These dressings only to be made in the tripe establishments of the abattoirs.

The butchers and their assistants to transfer these parts forthwith to the tripe preparers.

262. The tripe-dressers to remove these parts from the boiling-houses to the drying-houses immediately.

Remarks and observations on the Public Abattoir system of Paris, with explanatory remarks.

THE abattoirs, intended at first only to receive oxen, bulls, cows, calves, and sheep, required to be rendered complete by adding similar conveniences for pigs, and, at the present time, piggeries are almost everywhere united to the abattoirs for other cattle. Nevertheless, although by Article 2 of the ordonnance of April 15, 1838, the establishment of public abattoirs for pigs, suppresses the private killing of these animals, the authorities have thought it right to permit private individuals to kill pigs intended for their own family use, in closed places away from public paths.

In addition to the buildings used for the lodging of the persons employed, the abattoirs of Paris are composed of four parts entirely distinct:—

- 1st. That where the animals about to be slaughtered are kept.
- 2d. The abattoir proper, with all its accessories.
- 3d. The places where are prepared the entrails of the slaughtered animals.
- 4th. Lastly, those places where they prepare the tallow and fat.

There is nothing particular to remark on the places of reception for the oxen, sheep, and pigs, where are taken directly all the animals coming from the markets, except that they must be suffi-

ciently spacious, very airy and kept clean, particularly the piggeries, which must be cleansed every day.

The *abattoir proper*, commonly known under the name of *échaudoir* (boiling house), is built round one or more work yards completely paved, with gentle side slopes which conduct to a draft hole in the centre all liquids which run from the *échaudoirs* and from the yards themselves; a tap opened at each corner facilitates the cleansing. The buildings are divided into a certain number of workshops called "*cases d'abat*," paved and provided with a tap for washing, a hollow trough made in the pavement to receive the blood, a system of windlasses and pulleys to raise the body of the animal, of two frames on which are placed the rollers for suspending the quarters of beef, and long iron bolts or hooks for calves and sheep. The roofs of the *échaudoirs* project several yards, so as to protect the interior from the rays of the sun and to keep up a continual coolness. This coolness, according to M. Parent Duchâtelet, confirmed by the observations of Hugard, the elder, in Alsatia and Switzerland, is necessary, not only for the preservation of the meat in summer, but also for preventing the flies from attacking it. "There is neither canvass nor metallic gauze which can compare in this respect with a temperature lower by some few degrees than the surrounding atmosphere." An indispensable addition to the *échaudoir* is a court for the liquids. Into this are run all matters derived from the intestines, and all the filth of the *abattoirs*. These yards, known under the names of *voiries* or *coches*, and provided with the means of washing found necessary, are placed above a large drain, and cleaned out every night. In the pig *abattoir*, there are in addition burners or boilers, according as an open fire or boiling water are made use of to skin the pigs, and hangers where the dressing takes place.

Certain parts of the slaughtered animals, known under the name of "*issues*," and intended for the tripe trade, must undergo, *before being removed* from the establishment, particular preparations. From thence results the necessity of workshops perfectly isolated, some of which are reserved for washing and cooking the stomachs of oxen, cows, and sheep, and the preparation of sheeps' toes from which the wool and claws have been removed; and some serve for the preparation of calves' heads and feet, and for cooking sheeps' heads, or for washing, scraping, and dressing the intestines of pigs. It is right that these buildings, built of hewn stone, and consisting of one storey only, should have their summits constructed of a framework of iron covered with zinc.

The ordonnances of police do not permit in Paris the melting of tallow "*en branche*," by which is understood all the fatty parts of the animals, in any other place than the public *abattoirs*. The advantages of this regulation, as regards public convenience, cannot recompense for the grave inconveniences that are caused by it to the *abattoirs*. The melting takes place in stoves of not less capacity than 1,000 kilo-grammes. On account of the danger of fire from this operation, and which contributes to add to the opinion that the melting should be removed from the *abattoirs*, all lights must be kept in closed lanterns, and with a metallic gauze.

Water Supply.

Such are the different parts which compose an abattoir; but there is a condition essential to the salubrity of these establishments, viz., the water supply. "Before constructing an abattoir," says Parent Duchâtelet, "we must be especially careful about two circumstances of the highest importance:—

1. The means of having abundance of water.
2. The means of carrying it off again."

This two-fold consideration must govern the choice of localities for an abattoir. Wells, steam-engines, or mills, and reservoirs will serve to bring and hold the water. Not less than 20,000 gallons are required for the daily use of one of the Paris abattoirs, and at Rouen about 8,000 gallons. This water is not only made use of to wash the workshops and court-yards, in which places it should be continually flowing, but it is employed in the preparation and cooking of the entrails of the cattle, &c. It is also necessary that the water employed in the cooking of tripe shall have undergone no alteration, and that it is pure and well filtered. The Council of Health of Nantes has well pointed out the importance of this. As regards the water for washing, and especially the cooking waters, in which 300 or 400 stomachs have been successively boiled, the rapidity with which these putrify, and the noxious odours they exhale, require that an easy and unobstructed flow be secured for the waters which leave the abattoirs. There are different ways of effecting this end. The usual mode consists in special drains which lead either directly to the river or into other sewers, the fall of which should be at least one in fifty. At Rouen, where the abattoir is the model of cleanliness, the waters used for washing run into immense subterranean aqueducts, which meander through the entire abattoir, and conduct the waters to the lowest and most distant part of the establishment.

But whatever care is taken, the drains of the abattoirs which receive the remnants of animal matter, pieces of intestine, blood, &c., always give off a more or less fetid smell, and expose the men who clean them to greater dangers than the ordinary drains.

The cattle destined for food are conducted immediately to the abattoirs, where a special inspection is made by competent persons. It is prohibited to slaughter in these establishments any animals attacked with or suspected of being attacked with contagious diseases. The animals affected by other diseases cannot be slaughtered without the consent of the inspectors of the butchers, and in case of doubt, without the previous inspection of a veterinary surgeon. Animals dying accidentally in the abattoirs are subjected to the same provisions. Lastly, the meat itself must be inspected after the killing, and if found deteriorated, hurtful, or stinking, is seized.

Every public and communal abattoir, and the private abattoir of every town whose population exceeds 10,000, are ranged in the first class of unwholesome establishments, while the private abattoirs of towns, with a smaller population than 10,000, are placed only in the third class.

On the Practical Working of the Abattoirs of Paris.

To the Right Hon. Sir GEORGE GREY, Bart.

11, Hanover Terrace, Regent's Park,
May 1855.

SIR,

IN compliance with the instructions contained in Mr. Waddington's letter to me of the date of the 8th November 1854, to the intent that, if I considered it necessary to visit Paris to observe the practical working of the French laws for regulating unwholesome trades and occupations, I was authorized to do so, I beg to state that having visited the French capital for this purpose, I had every facility afforded me by M. Billault, the Minister of the Interior.

I have the honor of submitting the following observations on the practical working of the abattoirs in the neighbourhood of Paris.

I visited those of Montmartre, La Villette, and Menilmontant or Popincourt.

The abattoir of Montmartre, where, I understand, more beasts are slaughtered than in the whole of the four other abattoirs together, is considerably too small. It is also built too close to the contiguous houses, not being farther than fifteen metres from the adjacent tenements, the inhabitants of which complain loudly and repeatedly of the noxious odours emanating therefrom.

These odours are principally from the operations connected with the process of melting tallow. This is done in two modes: the old one consists in melting down the fat of the animals in a large copper holding nearly eight hundredweights, and placed over the open fire. The new process consists in placing the fat mixed with a certain proportion of water and a fiftieth part of the same amount of sulphuric acid in an air-tight closed copper, heated by steam. It is the former old method alone which appears to cause the very sickly disagreeable odour so much complained of.

The newly improved acid process is quite free from this disadvantage, and as I am informed, is about to be enforced in all cases in the Paris abattoirs. The tallow formed by the two processes varies in appearance, and to a certain extent in quality.

It appears that for all purposes of candle making, the one is as serviceable and makes as good candles as the other; but for the purposes of leather making, the tallow formed by the acid process does not answer so well as the other. I presume this to arise from the tallow in this case containing a small quantity of the sulphuric acid in combination with it.

This latter species of tallow is whiter and rather firmer than the open fire tallow.

The vapours given off by the old process attack the throats of the neighbours, causing a feeling of constriction and sickness. However, it does not appear that the workmen themselves, when they have once become habituated to these operations, experience any ill effects from them.

They are particularly healthy, being free from bowel complaints

and fever, and rarely or ever having attacks of cholera in seasons of epidemics. This is a fact that has constantly been given to me in evidence both in France and England, that workmen engaged in manufactories connected with dead animal matter are particularly free from disorders of this class.

All the bouveries or stables for the cattle, both of Montmartre and the other abattoirs, are far too low and close, and very deficient in means of ventilation. There is much ammonia given off, and the dung and manure are not changed sufficiently often—only once a month.

The semicircular windows are not nearly capacious enough.

The abattoirs, especially that of Montmartre, are far from being as clean as such places should be. The slaughtering courts are not well drained; the fluids do not find their way off the pavements sufficiently rapidly.

The courts themselves are too close and crowded; and from not being covered in with glass the workmen are exposed to rain during many consecutive hours in wet weather. They frequently suffer from cold and rheumatism.

In any abattoirs to be formed in this country, all the slaughtering courts should be at least ten feet wider than those of Montmartre; and the upper storeys of these, known by the name of “sechoirs,” having been originally built for the purpose of drying the hides of the animals before they were sold, are quite useless for this purpose, which is not carried out. The sechoirs are now only employed as dressing rooms for the journeymen butchers.

Much of the meat that is brought alive to the abattoirs by railway is injured by the hind quarters of the cattle being bruised. This part of the meat becomes injected with blood and quickly putrefies, especially in the summer, and is seized by the inspectors as unfit for human food.

I have the honor to be,

Sir,

Your most obedient servant,
WALLER LEWIS.

Ordonnances concerning Knackers.

A POLICE Ordonnance was issued in the year 1811 (24th August 1811), by Baron Pasquier, which contained 15 articles.

It ordered that in 10 days from that date all knackers then in business must present their licences, and get them renewed under regulations which would only accord licences to those who were provided, or would provide themselves, with certain tools, utensils, &c.

The ordonnance of that date was subsequently altered and modified by the following, dated 15th September 1842.

1. All persons exercising or wishing to exercise the occupation of a knacker must declare the same at the Prefecture of Police.

He must declare what tools and utensils necessary for that commerce he is possessed of, and these must receive our approval.

2. The carts and vehicles for the transport of the animals must be so constructed as not to allow the escape of any liquids, or the contents of the carts to be seen.

These vehicles must, before being used, be submitted to the examination of our agents. They will then receive an official stamp.

Independently of the metallic plate with which they will be furnished, the knackers must cause to be painted on some visible part of the vehicle, in letters at least six centimetres in length, their name, business, and address.

3. The vehicle must always accompany a train of live animals.

4. No living or dead animals intended for the knacker must enter Paris.

5. No knackers' operations are allowed to be carried on in Paris. These operations are only to be performed in the suburban establishments erected for this purpose.

6. The dead animals removed from Paris, as well as the living animals intended for the knacker, can only be taken to the knacker's, from midnight to 6 A.M. in the summer, and to 8 A.M. in the winter.

7. Glandered horses, and all other animals attacked with contagious diseases, dead or living, must be taken forthwith to the knacker's without stopping on the road, under any pretence.

8. Knackers to remove, on demand by any one, immediately, animals dead on the public paths, or in any private place.

9. Infringers of the last article to be brought before the public tribunals.

10. The ordonnance of August 1811 is repealed.

11. This ordonnance to be executed by the police, &c.

(Signed) G. DELESSERT.

Ordonnance concerning the opening and police regulations of the Knackers' Abattoir established by the City of Paris at Aubervilliers.

CHAPTER I.

Regulations relative to the Knackers.

1. The abattoir to open 1st November 1841.

2. Knackers already authorized may carry on their business at Aubervilliers.

They are to address their demand to the Prefet de Police.

3. If their operations require the aid of machines, furnaces, &c., they must, previously to erecting such, receive the authority of the Prefet of the Seine.

4. Animals intended for slaughtering, once brought into the establishment, cannot leave it under any pretext.

5. When live animals pass a night in the abattoir, a truss of hay, weighing 10 lbs., must be given to each horse or mule, and half a truss to each donkey.

6. Each stall serving as stable shall be cleaned out every morning by the knacker; the dung must be removed.

No animal remains must be mixed with the dung.

7. Every dead animal, brought in during the day, shall be immediately cut up, without leaving the spot.

Every dead animal, brought in during the evening or night, shall be cut up the next day.

8. Each knacker only to cut up the number of animals that it is feasible to cut up in a day.

All the products of the day that the knacker wishes to make use of must be removed from the knacker's establishment before nightfall, to be taken to the authorized establishments.

9. Knackers not to leave in the workshops any animal substance not disinfected.

Moreover, no accumulation of tallow, fat, skinning, shaving of skins, and skins themselves, or hoofs.

10. No blood of animals to run elsewhere than in basins provided for that purpose.

11. The barrels brought to remove the blood not to encumber the courts, nor to be placed in the workshops.

The barrels, when filled, must be removed every day, and not to remain there twenty-four hours; they must be cleaned externally with disinfecting powder, or some other equally efficacious means, so as to leave no smell.

All instruments to be kept clean.

12. No vehicles for transporting dead animals to be allowed to remain in the court-yards.

The horses employed in the service not to remain, even for a moment, in the stalls intended for the animals to be killed.

13. No tools to be left in the yards, but to be kept in the workshops.

14. Every matter coming from the knackered animals must, within twenty-four hours from the slaughtering, be transformed into products not putrefactive, or into disinfected products, or else to be removed from the establishment in covered and well-closed carts, and with all possible sanitary precautions.

An inspector to view the carriages or carts on leaving the establishment.

15. The knackers who follow the plan of the concessionaire to finish the slaughtering of their animals at 4 P.M. in winter, and 5 P.M. in summer. They must not, under any pretext, open the steam-boilers when the steam has been introduced; they must wait till the steaming is completed.

16. The knackers may give up to the concessionaire, without being obliged to disinfect them, all the products and residue.

17. Knackers' boys, to be admitted, must be provided with a *livret*, to be kept in the office of the inspector of the abattoir.

18. The knacker and his assistants to be each provided with trousers and waistcoat for working in, which they must wear while at work, but must not leave the abattoir in.

19. Journeymen not to destroy or damage any article belonging to the abattoir.

The masters are responsible.

20. No writing, tracing, or drawing on the doors or walls allowed.

21. All kinds of games of chance or skill in the abattoir disallowed.

22. Assistants not to sleep in the workshops, stalls, or stables.

No chandeliers, candles, or hand-lamps to be used in the workshops, stalls, or stables.

Fires to be extinguished when finished with.

23. Journeymen or boys who misbehave may be dismissed by the inspector.

CHAPTER II.

Of the Concessionaire of the Abattoir.

24. The concessionaire to keep in good condition the water-conduits, so that there shall never be a want of water in the different workshops.

25. He is to provide coppers and steam to the men who work in the northern establishments.

These coppers to be kept constantly in good condition by him, and as numerous as they are required to be.

He is also to provide steam for those in the southern establishments who shall desire to be supplied by his method.

26. Concessionaire to clear out horse-boxes, court-yards, and workshops every night; to clean, wash, and deodorize every part of the abattoir, if required for health, twice a day.

27. The same with streets, &c. of the abattoir.

28. He is to keep the reservoirs constantly filled with water.

The water that has been used in the cutting up the animals to be thoroughly disinfected.

The drains to be kept clean and deodorized.

29. The liquids to be emptied daily.

30. The concessionaire to disinfect immediately all unwholesome animal matter brought to the abattoir.

31. All live or dead animals brought or sent to the abattoir, and abandoned to the concessionaire, to be cut up and disinfected forthwith.

32. The concessionaire to deliver to the prefect for his approval a scheme for the healthy carrying on of the processes of disinfection, &c.

CHAPTER III.

Tariff of the sums to be paid for cutting up, &c.

33. There shall be paid to the concessionaire by the knackers and other persons licensed by the Administration, with the exception of those after mentioned, the sums following:—

For Killing and Cutting up.

For each horse, dead or living, ox, or cow	3	francs.
„ mule, pig, or ass	1½	„
„ small animal, dogs, cats, &c.	10	cents.
For unwholesome meats	2½	frs. per 200lbs.

For Cooking, Furnishing Steam, and for the Use of the Copper.

For each horse, ox, cow, calf, mule, or ass 1½ francs.

„ small animal, dog, cat, &c. - 10 cents.

For unwholesome meats - 2½ frs. per 200lbs.

Those who find their own steam to be exempt from these latter dues.

Tariff of location.

Annual rent for a single stall or workshop - 500 francs.

„ „ double „ - 1,000 „

34. No charges to be paid by persons sending or bringing objects to the abattoir and leaving them to the concessionaire, who is bound to accept them.

This rule applies to all objects sent by the police to the concessionaire.

35. The concessionaire must adopt the above tariff without increase.

CHAPTER IV.

Of the Theatre for judicial autopsies.

36. The knacker who has placed in the theatre the body of an animal, the cause of whose death is in dispute, shall, as soon as this has been settled, cut up the body and remove the different portions.

The concessionaire shall immediately clean the place.

37th. If the examiners charged with the *post-mortem* examination shall require that some portion of the body be kept, the concessionaire shall take all necessary precautions for health in so doing.

38. No other operations than those mentioned in Article 36 shall be carried on in the theatre without the authority of the prefect.

39. If such authority be given, it shall only be on those days when the theatre is not required for *post-mortem* examinations.

40. The concessionaire to keep the theatre clean at all times.

CHAPTER V.

Inspector of the Abattoir.

41. The abattoir and the workshops of the knackers are under the personal surveillance of an inspector, specially charged by this police with this duty.

42. The inspector to inhabit one of the lodges at the entrance of the abattoir.

43. He is to keep a register, where will be inscribed, day by day, distinguishing their species, the living and dead animals which are brought to the knackers.

44. He will supply to the Prefet de Police, weekly, a list of the animals killed and cut up.

45. If several animals of the same species shall have died within a short time of the same disease, giving cause to fear an

epizootic disease, the inspector will forthwith report the circumstances to the Prefet de Police.

46. He must not leave the establishment without our special permission.

47. If he has dismissed any journeyman for bad conduct in the abattoir, he is to send in to the Prefet a written account of the causes.

CHAPTER VI.

General regulations.

48. The trains of horses for slaughtering to be brought direct to the abattoir without stopping. They must traverse Paris only from midnight to 6 A.M. in summer, and from midnight to 8 A.M. in winter.

49. No strangers admitted without permission.

50. No animal, except those employed on the service or for slaughtering to enter the abattoir.

51. No pigs, rabbits, pigeons, poultry, goats, or sheep to be brought up in the abattoir.

52 to 55. Publication of this ordonnance.

(Signed) G. DELESSERT.

Description of the operations carried on, and the methods of preparation of the flesh and bones of horses and other animals slaughtered at or taken dead to the knackers' establishment at Aubervilliers, near Paris.

SOME idea may be formed of the importance of properly constructed knackers' establishments in the neighbourhood of large towns, when it is considered that, during the last forty years, there have been slaughtered at Montfaucon more than 400,000 horses, and 1,500,000 cats and dogs.

The live horses may be slaughtered in several manners: either by injecting air into the veins, in dividing the spinal marrow, or by killing them like oxen, as is done at the abattoirs. At the present time, the following method is generally pursued: The animal is attached to a stake, and a knife plunged into the chest opens the veins and arteries. Large quantities of blood escape by the wound. At first motionless, the horse staggers, falls, and dies in a few minutes, without apparent suffering. The animal is then turned upon his back, his blood is carefully collected, and his skin removed as speedily as possible by the aid of extensive incisions. The tail is cut off at the root, the feet removed, afterwards the limbs; the fat is carefully put aside, and the flesh cut off in large masses. This done, all the dismembered parts of the animal are thrown into the water in a large and well closed boiler, and submitted to the action of fire. Twelve or fifteen hours are required for the complete boiling. In Paris the boiler is put to

work by means of steam. When the flesh is well cooked, it has lost a large portion of its grease and gelatine, and is easily detached from the bones, the tissue of which is become more brittle.

The boiler then contains a quantity of liquid, divided into three layers; the upper stratum is grease, which is removed with large spoons, the middle is gelatine dissolved in water, the lowermost is a mixture of blood and other organic matter.

Messrs. Salmon and Payer proposed, in 1833,* the following process for the disinfection of dead horses, by means of steam pressure. The blood of these animals is collected with care, and after the skin and all the useful portions have been removed, the carcass, cut in pieces, is placed in a large iron case, together with the blood and entrails. This case, large enough to contain four horses, is placed in communication with a steam boiler worked at a high pressure. In an hour or two the flesh is completely detached from the bones, and converted into a kind of marmalade, which is afterwards submitted to hydraulic pressure.

The hair, skin, blood, muscular parts, entrails, tendons, fat, bones, even the shoes and nails, all may be utilized either for commerce or agriculture, or for the food of animals. The carcass of a horse may be made to yield from three to four pounds, or upwards.

M. Parent-Duchâtelet recommends the following as the principles to be kept in view by Boards of Health in erecting such establishments.

A surrounding wall shall encircle the building and yards, whose isolation is to be perfect. No habitation to be permitted within 150 metres; the wall to be of hewn stone, with a glazed surface; the blood to run upon an inclined plane, paved with stone or bitumen, and received in a barrel, immediately dried and mixed with the manure. All the gases and other emanations to be received in a tall chimney or flue, so as to convey them to a height in the atmosphere.

None of the operations connected with knackers to be carried on in the open air, with the exception of slaughtering. Cooking the flesh, the principal to be done in close vessels, and carried on by means of steam; afterwards the flesh, well pressed, dried, and pulverized, to be converted into manure. The slaughtered horse shall be cut up, submitted to all the operations of equarissage (the knackers), and removed from the abattoir within twenty-four hours. The yards must be perfectly paved with hard stones, cemented together with bitumen, and grooved with sloping channels for carrying off the waters and fluids. When loaded with organic matter, these waters would give off into the atmosphere noxious vapours, if exposed to the open air; they must, therefore, be received into cesspools, or conducted by covered channels into water-courses, if such there be within reach. Such waters as contain organic matter that cannot be otherwise utilized, shall be received into large parallel basins, and made into inodorous manure. All accumulations of fresh organic matter, bones, blood,

tendons, and skin, shall be strictly prohibited. In all large establishments of this kind, the slaughtering sheds should be provided with drying rooms open to the winds from every quarter, also with a sewer one metre in breadth by one and three-quarters in height, with a basin for receiving temporarily the organic matters, paved or covered with bitumen, in slope, and with the sides built of stone for a height of at least two metres.

The yards of knackers are ranged in the first class of unwholesome establishments.

However, there is no doubt at the present day, according to the observations of M. Parent-Duchâtelet, that the emanations from them are in no way detrimental to health, even to that of the children who are brought up or of the workmen who live in the immediate vicinity. The vegetation in the neighbourhood is a gainer by them. But the stench that these establishments give off, whatever precautions may be taken—the hideous spectacle they present—as well as the number of rats that always multiply there in an astonishing ratio,—every thing renders it impossible that any habitation should exist in their neighbourhood.

The Minister of Police having consulted M. Parent-Duchâtelet on this subject in 1832, was informed, among other things, that the police seized every year in the horse market, and sent to Montfaucon (the old knackers' establishment), 800 horses affected with farcy, glanders, or affected with black spots; that out of 250,000 horses reputed healthy, taken to Montfaucon during forty years, 144,000 proved to be labouring under contagious diseases. Nevertheless, although these animals have been killed, their skins mixed up together, their remains heaped together and spread on the soil, not only at Montfaucon itself, but also in the neighbourhood, there was no example of any case of glanders or smut being communicated to either man or animal employed in the establishment, or who had frequented it during many years.

On the practical working of the public slaughtering establishment for killing diseased or worn-out horses, cows, dogs, &c., at Aubervilliers, near Paris.

Operations carried on at the Abattoir of Aubervilliers.

1. The slaughtering of the larger animals, having only for object to separate the hair, hide, and feet, which are sold without undergoing any preparation; the animal is then cut up into pieces weighing from six to ten kilograms, which are placed in the large air-tight steam boilers, and boiled under great pressure.

2. The slaughtering of dogs, cats, sheep, &c., only the skins of which animals are taken off and sold after being dried. Their carcases are then placed whole in the boilers, with the larger animals.

3. The cooking takes place in large boilers, containing about three kilolitres each (3,000 quarts); these are made of sheet

iron, six or eight millimetres in thickness, having two doors each for the insertion of the flesh, and are provided with a double bottom, the upper one of which is bored with holes. The false bottom is placed half a metre above the true bottom at the level of the lower door, the upper door being fixed in the highest part of the side of the boiler.

The flesh must be so placed in the boiler that it does not form a solid compact mass, but that by means of the head, the bones of the limbs, and those of the pelvis and chest, interstices are left so as to leave a passage for the steam, which is introduced into the boilers at a temperature of from 112° to 121° of centigrade ($1\frac{1}{2}$ to 2 atmospheres) during a period of ten or twelve hours.

This steam, condensing on the flesh, carries with it into the space between the two bottoms the oils and the gelatine. These two products are withdrawn by means of a tap, but the gelatine is not utilised.

At the termination of the boiling, the bones and the flesh completely separated are drawn out by the door placed above the false bottom.

The former are sold to the manufacturers of animal black, the latter are placed in a press of great power, in order to remove the remainder of their oils. This flesh is afterwards picked into small pieces by hand, spread out on the ground in a hot room, dried, ground, and sifted through sieves, and afterwards sold as manure.

These operations are all very offensive, but do not appear to have any ill effect on the health of the workmen after they have once become accustomed to the work. Sickness and loss of appetite are generally experienced temporarily by those who are fresh to that or similar work. The abattoir is very isolated. The manager, M. Collignon, is a most intelligent person. His remuneration, under the police, is only 4,000 francs (160*l.* per annum). Between six and seven thousand horses are, on the average, annually slaughtered there. They are bought at an average price of from seven to ten francs.

Instructions for preserving the Public Health, and protecting the health of the artizans and others employed in cleaning and preparing intestines of animals.

Gut cleaning.

THIS occupation comprises the fabrication of different products employed in the arts, formed from the intestines of oxen, sheep, and horses.

The cleaners commence by separating the fat that the butchers have left adhering to the intestines, and which serves to make very inferior tallow. The intestines are first emptied, by running water through them; afterwards, in order to detach the parts of the peritoneum still remaining attached, the guts are steeped in

large barrels of water during two or three days in summer, and six or eight in winter. When putrefaction is sufficiently advanced, the intestines are thrown into buckets of water frequently renewed, and the workmen scrape them with their nails throughout their entire length. They are then ready to be blown. For this purpose the workman makes use of a piece of reed which he introduces into the base of the intestine, and with the mouth blows air into it, and makes a ligature at a distance determined by the condition of the bowel. This is frequently torn, and the apertures would allow the air to escape. Lastly, the gut so inflated is dried by the air, and taken to the sulphur room, where it is bleached and deodorized.

It is impossible to form an idea of the horrible stench which pervades establishments of this kind, and which is disengaged not only from the large vessels in which the putrefaction of the intestines is carried on, but also from the solid or liquid residue which encumber at all times the soil, and in the midst of which the cleaners live without attempting to diminish the stench developed by the process.

This extreme carelessness, which strikes with astonishment all those who have the courage to visit such establishments, arises partly from the fact of the stenches which abound there not giving rise to the fatal effects upon health which one might expect from them. Parent-Duchâtelet affirms that the emanations from these gut establishments may be breathed with as perfect impunity as the most agreeable odours. Neither the workmen who live in this pestiferous atmosphere, nor the persons who are temporarily exposed to it, according to Parent-Duchâtelet and Guersaint, experience any ill effects from it. The inflation of the bowels, however, presents strong indications of insalubrity. One has difficulty in understanding how a man can work at such painful labour as this inflation. The infectious air which comes out from the intestines penetrates his chest and causes him extreme fatigue, so that he can only continue this painful exercise for a few days at a time.

The air which passes through the bowel spreads through the factory, and carries a stench difficult to describe. Messieurs Chevallier and Guérard report that, in the visits they have repeatedly made to these establishments, they have been informed that the workmen, at the commencement of their work in these establishments, were in a few days attacked with fever and derangement of the digestive functions, which required a course of purgatives for their relief.

Use of Chlorides.

However, since Labarraque's discovery of the disinfecting powers of the chlorides, it is now quite possible to prevent innumerable inconveniences, up to that time inseparable from the preparation of intestines.

After the bowels have been cleansed from the fat, and for a barrel inclosing the small intestines of fifty oxen, there should be

used two or three buckets of water containing $3\frac{1}{4}$ lbs. of chloride of soda. The intestines then lose all colour, the membrane is easily detached, and their inflation is completed without any inconvenience; the disinfection is complete, and no change need take place in the ordinary processes of the workmen.

Messieurs Chevallier and Guérard recommend that the bowels should be emptied at the abattoirs themselves, and that they should be washed at the gut-cleaning establishments with chloride of soda before proceeding to remove the fat and inflate them.

The same authors advise the gut-spinners to utilize for agriculture the offal and other matters that they are obliged to throw away in such large quantities, after disinfecting them with charcoal or the disinfecting powder of MM. Payen and Salmon, which is only earth containing vegetable matter, and which, submitted to calcination, acts by means of the finely divided charcoal it contains.

The gut-spinning establishments are ranged, by decree of 15th October 1810, in the first class of insalubrious establishments. It is generally enacted that all these establishments should be isolated at least 100 metres from any habitation, and situated, if possible, on the borders of a river or stream. If there is no water-course near at hand, there must be a well, furnished with abundant supplies of water at all seasons.

ORDONNANCE relating to GUT SPINNERS and MANUFACTURERS of MUSICAL CORDS.

WHEREAS the situation and the arrangement of the workshops of the greater number of gut-spinners and manufacturers of music strings, present inconveniences as to ventilation and discharge of the waters; that these inconveniences aggravate those that result from the imperfection of the processes employed by the manufacturers in the preparation of the intestines, with regard to the public health; and whereas while waiting till it shall be possible to improve the manufacture, it is necessary to oblige manufacturers to take the requisite precautions to diminish these evils, We therefore ordain:—

1. All persons desirous of forming any of the establishments comprehended under the three classes in the Royal Ordonnance of 14 January 1815 must apply for permission to the Prefet de Police.

2. The localities named for establishing manufactories of gut spinning or musical strings, must be at least 110 yards distant from any habitation, (except such as are equally unwholesome,) and must be situated whenever possible on the bank of a river or stream.

If there be no river or water-course in the neighbourhood, such deficiency must be supplied by a well furnishing an abundant supply of water.

A plan, showing the localities and the projected buildings,

must be appended to every application for permission to establish such manufactory.

3. No gut spinning works, or any other establishment giving out unwholesome or disagreeable smells, can be established without permission given in the forms prescribed by decree 15 October, 1810. Art. 1.

4. Every gut spinner or musical string manufacturer, whose factory is at this time legally established, is hereby enjoined, if not already provided, to sink a well that will supply in all seasons sufficient water for the requirements of the works.

5. No cesspool for the reception of the washing and steeping waters allowed to be made under any pretence.

Existing cesspools shall be filled up and suppressed without delay.

6. Waters used for washing and steeping not to run into the public pathways, but they must be collected in a barrel, placed in some vehicle, to be emptied at night into some channel or sewer or neighbouring river.

7. The barrels for the maceration of the intestines to be placed in a paved shed or workshop, open if possible to all winds.

Those manufacturers whose workshops are not so arranged, to alter them accordingly without delay.

8. The police to send in official reports of all infringements of this ordonnance.

Such infringements to be punished conformably to the laws.

9. This ordonnance to be published.

(Signed) COUNT ANGLÈS.

On bone-boiling and depôts of bones, the manufacture of animal charcoal, &c.

BONES have formed, since 1813, the period at which animal black was first used in the fabrication of sugar, a very important branch of commerce.

The largest portion of bone charcoal consumed in France and her colonies was made originally in the department of the Seine; this is easily understood, as the raw material is more abundant there than elsewhere.

The bones form about one fifth of the entire weight of the recently slaughtered animal, and in Paris nearly 11,713,500 kilograms of bones are annually made use of. Every year, also, the importation of bones from the provinces and from foreign countries increases. The Departement du Nord has undertaken on a large scale the fabrication of bones into charcoal for her numerous sugar manufactories. The establishment of M. Kuhlmann, near Lille, is one of the finest and best conducted of this kind in the empire, and is indeed a model one.

All the bones collected are not employed in the fabrication of charcoal. Those which are sufficiently large, heavy, and thick, are

intended for making into handles of knives, forks, &c. The remainder are divided into two sorts, wet and greasy, and dry.

The former come from the butchers and are still fresh, or have served culinary purposes. They contain about 9 per cent. of grease. After extracting this substance from them, they are then employed, under the name of boiled bones, in the manufacture of animal black. One portion of them is treated in large coppers or boilers, in order to extract their gelatine, by the process called "Papin's." The dry bones are at once turned into the animal black. A few words on the organographic and chemical composition of bones will serve to point out more clearly their properties.

Bones contain per cent.,—

Organic matter = 50		and	Mineral substances 50	
viz.,			viz.,	
Fibrous tissue	32		Phosphate of lime	38
Fat - -	9		„ magnesia	2
Albumen, vessels, &c.	1		Carbonate of lime	8
Water - - -	8		Various salts -	2

The greater part of the organic matter constitutes a spongy tissue, in which is found the mineral substances.

This tissue is transformed almost entirely into gelatine by boiling in water.

It is very easy to isolate the organic tissue from the inorganic. The bones are digested in water acidulated with from the 0.20 to the 0.25 of its weight of hydrochloric acid; all the salts of lime dissolve, and there remains a soft transparent substance requiring purification:

1stly. By aid of a weak solution of hydrochloric acid.

2dly. By a thorough washing with pure water.

The organic tissue thus purified is very supple as long as it is combined with water; it retains the form of the bone.

When it is required to extract the grease from bones, they must not be allowed to become dry first.

When fresh bones and some more or less dry are collected in considerable quantities they give off effluvia which may affect public health; therefore, these dépôts should only be tolerated in large spaces of ground, situated in quarters thinly inhabited and capable of free ventilation. The fetid emanations that escape from accumulations of bones are constantly the source of loud complaints from the neighbours. The Council of Health and Salubrity of Versailles being consulted on this subject, proposed to place the mass of bones in a covered building, perfectly aerated, and to make use of a layer of animal black requiring revivification, and even, if necessary, new active black, in order to absorb the emanations. These applications are certainly to be approved, but are they sufficient to prevent putrefaction, so readily developed in animal matter, having once commenced in the heap of bones? These heaps, disturbed to furnish material for the day's work, will be certain to allow the emanations momentarily shut up in their interior, to escape through the openings. It appears clear that the means indicated would essentially fail in the necessary con-

dition, namely, that of a permanent and continuous effect. As to using the perfect "animal black," we are of opinion that if applied according to the quantity that would be necessary to insure its efficacy, it would cause so much expense and difficulty that few manufacturers would faithfully carry out such a measure.

The Council of Health and Salubrity of Dunkirk was consulted in 1852, as to a request made by a possessor of such a dépôt, and who, by a simple order of police had been obliged to shut up his works. The police order was founded upon :

1. As dépôts of bones were classed in the second rank of insalubrious establishments, the Prefect of Police alone has the regulation of such.
2. As the establishment was anterior to the promulgation of the decree of the 15th October 1810, the regulations in article 11 of the said decree were applicable to it.

The following was the decision arrived at by the Council :—

1. Mr. ——— must only admit into his warehouse kitchen bones perfectly clean and dry; the quantity accumulated at one time never to exceed 200 kilograms (about 420lbs.)
2. He is formally interdicted from receiving any other osseous matters coming from the public knackers or the tanneries.
3. Twice a week, Tuesdays and Saturdays, the warehouse to be completely emptied.
4. The spot where the bones are deposited shall be perfectly ventilated; it shall be paved with hard stone, and cleaned carefully the two days named.

If dépôts of bones are a powerful cause of insalubrity, the operation of extracting the grease from them disengages odours much stronger and much more disagreeable. This industry is directly connected with the manufacture of animal charcoal and of bone buttons. The Council of Health of Bordeaux was consulted in 1851 as to the keeping up of an establishment for de-greasing bones, to which was annexed a manufactory of bone buttons.

The following was the adjudication :—

"The Commission, after due examination of the places and factory, has not shut its eyes to the inconveniences attached to de-greasing bones; but these inconveniences will be annulled if the following conditions are made peremptory :

1. The bone-boiling shall be performed in a close boiler.
2. The internal pressure of the boiler never to exceed an atmosphere and a-half.
3. The boiler to be furnished with the safety apparatus required by the Royal Ordonnance of 1843, regulating steam-boilers.
4. The greasy waters cannot remain more than 24 hours in the establishment, and cannot under any circumstances, be poured on the public ways or shut up in the establishment.
5. After having been boiled, the bones are not to remain above 24 hours in the establishment.
6. The furnace chimney must be elevated at least 8 metres above the soil.

With these conditions, the public health and security have appeared to your committee sufficiently provided for."

After the bones have been sorted, so as to make use of the best for table use, and after having been de-greased and half-dried in the air, they are *carbonised* for the formation of animal black. This product is obtained by heating the bones out of contact of the air, by decomposing the organic matter and volatilizing the *gases*, so as to sift out the charcoal interposed between the inorganic substances. The quantity of charcoal contained in the black of bones is about 10 per cent.

The bones are carbonized in cylinders or in large melting pots of baked earth, which are generally three-tenths of a meter in diameter and four-tenths in height. They are then gradually heated in a furnace to a white heat, which is maintained from six to eight hours, and the pots when cold are removed. The charcoal is then powdered between cylinders.

The manufacture of animal charcoal itself has no special inconvenience, except the dangers inherent in all operations which put in movement pulverulent bodies, and which require considerable heat by means of ovens or furnaces, which may cause danger from fire.

What requires the strictest attention to be devoted to this class of works, however, is, that frequently they join together several different sorts of works, and become in fact several knackers' establishments, factories of animal charcoal, and of manures.

Powdered animal charcoal is principally employed in the clarification of sugars and vinegars. This operation consists in adding, for sugar, three kilograms of animal charcoal in fine powder to 100 kilograms of raw sugar, with one or two kilograms of albuminous matter coagulable by heat; bullocks' blood beaten and thus deprived of its fibrine, then mixed with four times its volume of water, is made use of for this purpose. The residuum of the animal charcoal is sold as a manure under the name of "black from the refineries."

Ordinance respecting dépôts of manure and of collections of animal matter.

WHEREAS there is constantly formed in country places in the suburbs of Paris a considerable number of dépôts of manure composed of mud, sweepings of the streets, filth, and remains of animal matter, which give out infectious exhalations; and whereas it is important to preserve the habitations as well as the high roads from the unhealthy effects that might be produced by these exhalations;

We ordain,

1st. No dépôt of manure composed of animal débris coming from the abattoirs, or gut spinners, or knackers, or glue factories, or other workshops of the kind, shall be formed at a less

distance than 220 yards from any habitation, and 110 yards from the high roads.

2d. If these manures have not been made use of for the space of two days, counting from the day on which the dépôt has been made, the agriculturist while waiting to make use of it, is to place it in a ditch and cover it over with a layer of earth two inches at least in depth.

3d. All deposits of mud and filth intended for sale, with the exception of the contents of the sewers ordered for sale by the authorities, to be kept at a distance of 280 yards from habitations, and 110 yards from the high roads.

4th. The above orders not to apply to dung of horses, cows, and sheep.

5th. Infringements, when proved, to be punished according to law.

6th. This present Ordonnance to be printed and published.

(Signed) G. DELAVAU.

ORDONNANCE CONCERNING DEPÔTS OF MANURE AND FILTH in the SUBURBAN PARTS.

We ordain :

1st. No dépôts of mud and filth, except those coming from the sewers and ordered to be sold by the public authorities, are to be made without our authority.

2d. In no case shall authority be granted to form such dépôts in the interior of court-yards, gardens, or other enclosures contiguous to habitations, or in open spaces which are at a less distance than 200 metres from every habitation, and 100 metres from high roads.

This distance may be shortened when the high road is only used for agricultural purposes.

3d. When the mud and filth are being applied as manure to the soil, it shall be done within twenty-four hours of their being brought to the spot.

4th. Horse, cow, and sheep dung not to be included in the above articles.

5th. Infringements to be punished.

6th. The Ordonnance of 31st May 1824 to be abrogated.

7th. This Ordonnance to be published.

(Signed) G. DELESSERT.

On the large establishment for the manufacture of Poudrette, or artificial manure, in the Forest of Bondy, near Paris.

PARIS being entirely unprovided with a system of sewerage, the whole of the night soil has to be removed by manual labour.

This is done in the following manner, and with the following results:—

The houses are provided with cesspools, either fixed or movable. The former are known by the term “*fosses immobiles*,” the latter “*fosses mobiles*.”

The former are emptied in two ways, either by the descent of men into them, or by withdrawing their contents by means of a large iron cask or tumbril, exhausted of its air, connected with the cesspool by means of a flexible tube. Although this latter method was far less objectionable than the former one, as the workmen were saved a considerable amount of very filthy work, and the fosse was emptied with much greater rapidity, and a much less amount of nuisance was caused during the operation, nevertheless the mode of emptying by exhaustion has been obliged to be abandoned, on account of the great expense of keeping the apparatus in a state of efficiency. The large iron vessels formerly used in this process are now employed in the old method. But the greater number of houses in Paris are supplied with strong wooden barrels, which, when full, are removed, and their places supplied with others empty. This industry is carried on by contractors, who perform their contract under the strictest police regulations. The firm that contracts for the greatest number of the houses in Paris is named Richer and Co., who, I am informed, do this work for five-sixths of the houses in the capital. Their establishment is very large, and the operations are carried on with as small an amount of bad smells as such a business will admit of. They adopt what is called the “*système diviseur*.” This consists in receiving all the night soil in a fosse with a false bottom and sides, which, being perforated, allow the liquid portions to escape by means of a tube and stopcock into another fosse in connexion with the first receptacle, and which second fosse, not being perforated, retains the liquids.

The contents of the fixed cesspools are removed in very large barrels; and the moveable cesspools themselves, containing separately the liquids and solids, are conveyed in carts to a place constructed for this purpose. It is called the *Dépotoir*, and is situated just outside of Paris, at the Barrier of La Villette. From this place a canal is constructed to Bondy, and by this canal the large and small barrels, containing the solid matters, are conveyed to the manufactory of poudrette at Bondy in barges.

The liquid portions are not conveyed in that manner. The distance between the *Dépotoir* at La Villette and the forest of Bondy is about 12 kilometres. A large iron tube runs underground from the former place to the latter, and the liquids are pumped, by means of a powerful steam engine, through this tube to the place of reception at Bondy.

The manufacture of poudrette is carried on in the interior of the forest of Bondy, at a distance of 13 kilometres from Paris. It is at a distance of about a kilometre in a direct line from the public road, and surrounded with trees.

These and other precautions, however, by no means prevent

this factory from being a very great nuisance, and a pregnant source of complaint from the inhabitants of the neighbourhood for a very considerable distance round it.

When I visited this locality, although the weather was very cool, the odours made themselves perceptible at a distance of five kilometres; and I am assured on good authority that in hot weather, with a wind blowing from that direction, the smell is distinctly perceived in the metropolis. I was particularly struck with one circumstance regarding the smell given off, which was strengthened by the evidence of M. Trebuchet, the *Chef du Conseil de Salubrité*, who accompanied me. It was, that the odour was far less offensive at the factory itself, where the work was being actually carried on, than it was at a considerable distance from it. M. Trebuchet assured me that this fact had been observed by himself and numerous other persons.

However, the complaints from owners of property in the neighbourhood are both loud and deep, and I am informed that the value of property has considerably diminished since the factory has been established there.

The process of manufacture is as follows:—

The solid matters, arriving in the large and small barrels by canal and boat from the *Dépotoir*, are emptied into one of two very large basins excavated in the soil. These are each about two acres in extent, and ten feet in depth. From these receiving basins the liquid portions pass slowly off to other basins; and after depositing the more solid portions therein, the liquids pass off to other basins, numbered 3 and 4, consecutively. The liquids from the last basin (No. 4) are sold to the proprietor of a large establishment erected contiguously, and sulphate of ammonia is extracted from them after the deposition of as much of the solids as possible.

The solids that have been deposited are dried by long exposure to the air and by frequent turning by hand, until after a lapse of time, varying from two to four years, they become so dry as to fall into a powder; and this is then disposed of under the name of *poudrette*.

Although, from the evidence brought before me, there is little doubt that this *poudrette* is a very fertile species of manure, still there is a great prejudice against its employment among the farmers and market gardeners in the neighbourhood of Paris. The conductor of the establishment informs me that it is all sold to farmers residing in distant parts of the country. He added that no farmers will purchase the liquid, nor indeed would they use it even if given to them for nothing. This has been tried.

The town of Paris is paid 85 centimes for every cubic metre of solid and liquid that enters the factory.

The *voirie* of Bondy, where the *poudrette* is made, measures superficially 32 hectares. The eight basins which receive the liquid and solid matters hold 160,000 cubic metres. The Canal de l'Oureq is the medium of transport of the solids from Paris.

Manufactories of glue and size, placed in the 1st and 3d classes of insalubrious establishments according to the materials used in their manufacture.

Glue. Size.

UNDER these names are distinguished those adhesive substances that are prepared from animal matters more or less rich in gelatine, as membrane, skin, fascia, tendons, cartilage, bones, &c.

The raw material used in the preparation of glue are—

Scrapings of skins prepared by the leather dressers, called *brochettes*.

Buenos-ayres or packing skins and parings of skins coming from Brasil.

The soles or large tendons of oxen.

The clippings of parchment.

Pieces rejected by the tanners, as sheep's ears, calves' toes, tails, &c., and lastly, bones, which scarcely fifty years ago were accounted of no use whatever, and which are now become so great an object of industry as to be imported from foreign countries.

The preparation of the tendinous and membranous materials consists in macerating them for several days in milk of lime, then straining and drying them, afterwards separating them in boiling water in a water-bath, continuing the ebullition until the liquid in the boiler on exposure to cold air becomes a thick jelly.

To extract gelatine from bones, the grease must first be extracted, for which purpose they are boiled in water, after being broken in small pieces; the grease melts and floats on the surface of the liquid, from which it is removed with a spoon. After removing the grease, the gelatine of the bones may be extracted by two different methods:—

1st. By heating in a boiler called "autoclave."

2d. By removing the calcareous salts contained in the bones by means of muriatic acid.

In the first process, the bones are mixed with lime, which separates the last remains of grease from them, then submitted to the action of very hot water = 248° , in a boiler capable of supporting a pressure of several atmospheres. At this elevated temperature the bones become soft, the gelatine dissolves in the water, and the calcareous matter, while preserving its form, loses its hardness.

By the second process, the bones are macerated in tubs containing muriatic acid of ten degrees of strength at the most; by this operation, the carbonate and phosphate of lime in the bones are dissolved, and the animal matter remains untouched. After being removed from the acidulated water, the bones are drained, washed, then allowed to macerate sufficiently long to saturate the hydrochloric acid and the acid phosphate of lime remaining in the waters; lastly, when the alkaline maceration is finished, the bones are boiled in a steam boiler, as if they were membranous substances.

Before the glue is run into buckets, it is clarified, if not already

very transparent, by means of alum, if it is alkaline; by albumen if neuter. Lastly it is dried in a drying room.

The factories of glue are classed, by the Ordonnance of 15th October 1820, in the *first class* of inconvenient or unwholesome establishments, on account of the bad odours they cause. However, when bones only are used, they are placed in the *third class* by the Ordonnance of the 9th February 1825.

Messieurs Montfalcon and de Polinière remark on this subject, that flesh is frequently made use of in establishments only authorized to extract gelatine from bones, and that sometimes there is great difficulty in providing against such an infringement.

Glue manufactures, therefore, are not authorized within a certain distance of inhabited places, and in taking into account the ordinary direction of the winds: it does not, however, appear that they present any condition of real unwholesomeness.

The waters running from these factories are charged with a certain quantity of animal matter as well in solution as in suspension; they give off a disagreeable odour, and take on putrefaction very rapidly. They must be discharged, after as short a journey as possible, into cisterns or butts, which must be emptied on a neighbouring field or meadow, or into a sewer if the locality permits.

On tanning, dressing, and currying leather.

LIKE all establishments in which animal matters undergo preparation, tan yards are foci of emanations, more or less disagreeable, but which can scarcely be considered noxious.

There is scarcely any town of importance where such establishments do not exist, and every where councils of salubrity are unanimous in acknowledging that leather dressers present but few inconveniences, and authorise them under certain conditions.

The preparation of skins comprises a series of operations, which it will be useful to repeat.

The skins, brought in fresh or green or previously salted and dried into the establishments for tanning, are immediately submitted either to immersion in lime or to the action of steam or of a current of hot water, or lastly to the action of running water, after which the hair is easily removed by scraping. This first part of the operations, which the neighbourhood of a stream of water much facilitates, is known under the name of "*rivering*," and explains the situation of the greater number of tan-yards. It may, however, without difficulty be carried on in the interior of the establishment.

The hide thus prepared is submitted to the operation of tanning, either by alternate layers of skin and tan or bruised bark of oak, or by the action of alum. To these very long operations succeed the drying, and subsequent greasing by aid of melted tallow or oils. The manipulations of the currier and of the morocco maker, who place the skins, more or less finely prepared,

in a state to be worked, are less complicated, and consist chiefly in moistening, beating, greasing, and dyeing the leathers.

This short description is sufficient to show that the work of the tanner gives rise to the production of a great quantity of solid and liquid residues of organic nature and easy of putrescence, an accumulation of which would constitute an evident cause of disease. But these inconveniences may easily be avoided by means of certain very simple precautions.

The fresh skins should be immediately, at the moment of their arrival, plunged into lime water or into any other liquid that will render them imputrescible. The subterranean reservoirs for receiving the foul waters, the coppers, the pits, ought to be perfectly air-tight; the courts and all the dependencies of the manufactories should be paved with well jointed sandstone, and should present an inclination sufficient to direct all the liquids to the general receptacle.

The dirty waters, called greasy waters, must be transported out of the establishment, either by subterranean drains or in well closed barrels, as far as a stream of water, where they may be emptied without inconvenience. The mass of hair and tan must not be retained in the interior of the works.

Tanneries, currier's yards, and leather dressers are classed in the *second* class of unwholesome works.

A peculiarity, only recently pointed out, relating to the influence of the profession of tanning is worthy of notice.

The leather dressers of Annonay, according to M. Armieux, and undoubtedly also, those of all countries, are subject to diseases of the fingers not described by any author. The first consists of an ecchymosis which invades the internal portion of the fingers where the epidermis is very thin. This ecchymosis, which has a blackish appearance, remains in this state several months without becoming troublesome or painful; but more often the skin ulcerates, and then the workman undergoes most severe sufferings by the contact of the bleeding surfaces with the lime, which it is impossible to avoid using in preparing the skins.

Some few days of repose, and the application of a simple ointment, usually suffice for the cure of this malady; but it relapses frequently when the workman exposes himself anew to the cause which has produced it, constant contact with lime water. The workmen call this disease *cholera of the fingers*.

The second disease is named by them *Nightingale*, because it is still more painful, and makes them throw out cries of pain. This consists in a small cavity which forms at the extremity of the pulp of the fingers; this cavity, which appears to be capillary, is due to the thinning of the skin corroded by the lime. There is exudation of small portions of blood, communication of the atmosphere with the nervous papillæ, and severe pains.

The workmen continue their trade in spite of this, and do not appear to experience any evil consequences therefrom. The mischief disappears without any medicine, by the mere cessation from work.

"If the workmen," says M. Armieux, "would prevail upon themselves to wear oilskin gloves, it is probable that they would preserve themselves from these disagreeable accidents. I have recommended them, but they have invariably replied, 'It is not the custom,' so true is it, that routine is the most terrible and incurable of evils."

*On various establishments of tanners and curriers
in Paris.*

THE tanneries of Paris are under the strict surveillance of the police, and are not allowed to be established in any locality that is not provided with an abundant supply of water. The more important establishments of this kind, indeed, in the interior and in the suburbs of Paris, are situated on the banks of some running stream, and preference is always given by the authorities to such works as select such a site for the erection of their factories.

The greatest attention is required to be given to ventilation, so that thorough currents of air are established in all the workshops.

The first step in the process of converting hides of animals into leather, a step common to all factories as well in France as in England, is the placing the hides in a mixture of lime and water, known by the name of the lime bath.

This has for object to remove the hair by the caustic quality of the lime. The next process, which appears to be in universal use among the tanners in the vicinity of London, or at any rate among those whose works I have had occasion to visit in Bermondsey, is one that I have been informed by some of the London tanners as quite indispensable.

Its object is to remove the superfluous lime, which, from long contact with the skin, lodges itself in the pores or cellular tissue thereof. This is attained in the London factories by steeping the hides, after the removal of the hair, in a solution of the putrified dung of dogs, pigeons, or certain other animals. To so great an extent is this process carried on in the metropolis, that I am assured by the local police and other persons, that between 300 and 400 persons are employed in collecting the feculant matter from these animals, especially dogs. This is purchased by the tanners, by whom it is known under the name of "pure."

I am informed that the term is intended to convey the idea of the dung so purchased consisting purely of the dung of dogs, without admixture of that of other animals.

This faecal matter must be kept in mass until it is in a state of hot fermentation, when it gives off large quantities of carbonic acid, sulphuretted and phosphuretted hydrogen gases. It appears then to be fit for use.

But this process constitutes by itself a very considerable nuisance. The gases given off from the fermentation of this excrementitious matter, pervade more or less the whole establishments, and can be smelt at a considerable distance. In inquiring into

this part of the process of dressing leather in Paris, with the object of learning what other, if any process, could be substituted for this most objectionable operation, I learn that it is utterly unknown in France. I am informed that the lime is most completely removed from the skins by the French manufacturers, by various mechanical processes. These all assume the form of pressure, with complete washing with large quantities of water.

The most perfect plan for removing the lime left in the skins that I have seen in operation in the French factories, is the one invented by Messrs. Artus, and patented by them in France, though not, I believe, in England. It is known by the name of—Appareil purgeur Système de Artus frères, vendeur de l'appareil. 1853.

Constructeurs { M. Delpéché, mécanicien,
 { M. Choureaux, tonnelier, Paris.

It consists of a large, hollow, wooden wheel, $2\frac{1}{2}$ metres in diameter, fitted in the interior with a number of blunt wooden teeth, and pierced with numerous holes. A tap, connected with a cistern of water, opens into the interior of the wheel, into which the limed skins are thrown, and the wheel is then rotated rapidly by the steam-engine that works the other parts of the factory. The water escaping through the holes is for some time very white and turbid, from its containing a certain quantity of lime; but this gradually being washed out of the skins, in a period varying from twenty minutes to an hour, according to the size and number of the skins in the apparatus, the water comes out as it went in, and the skins are then found to be free from the caustic material. One such apparatus will, I am informed, cleanse from lime a great number of skins. Messrs. Artus, who only, however, prepare the smaller sized skins for varnishing, have only two of these appareils, and thus finish 1,200 skins per day.

The apparatus complete costs 2,000 francs, or 80*l*.

Another improvement relating to the business of tanning, but not having reference as the one just described has to the public health, is a patent that has lately been taken out for forming the shavings and scrapings made in dressing and currying the skins into good solid leather fit for manufacturing into soles or boxes.

This is done by steeping these remnants in glue, and afterwards submitting them to considerable pressure.

This patent is secured by M. Roulier, 24, Rue St. Bernard, Paris.

The factory of M. Leven, père et fils, Rue St. Hippolyte, No. 10, is a model tannery establishment. The health of the workmen is better than at any other similar works in Paris or elsewhere that I have visited. The paving, ventilation, drainage, and lighting, are all effected in a most superior manner.

Some of the largest skins are not steeped in milk of lime at all in M. Leven's factory.

*On the precautions necessary to be adopted in the
exhumation of dead bodies.*

THERE are circumstances where the necessity of recognising the identity of a body, or of searching for the traces of a crime, or other reasons, make it a duty to remove a corpse from its grave, or authorize this operation, a thing otherwise altogether an exception to our ordinary manners and habits.

The putrid decomposition that goes on in corpses, and the miasmata they exhale, necessitate great precautions. But the dangers that the act of exhumation presents have been much exaggerated. The emanations given off from animals in a state of putrefaction, when exposed to the open air, appear generally free from much inconvenience to the health. Parent-Duchâtelet made many observations on this subject in the public knackers' yard of Montfaucon, proving the complete innocuousness of an enormous accumulation of putrefying flesh. The exhumations of the cemetery and of the church of the Saints-Innocents in Paris, performed in 1785-86, lasted six months; more than from 15,000 to 20,000 corpses, belonging to many ages, were exhumed with their coffins. "One remarked," says Thouret, "all shades of destruction, all the metamorphoses of death assembled, from the body which was in a state of solution and putrefaction, to those that were changed into mummies, dry and fibrous; notwithstanding which, no accident whatever happened among the workmen or neighbours.

Gravediggers have themselves observed, moreover, that they are only exposed to real danger in the *first period* of the decomposition of the bodies; that is to say, some days after their interment, when the abdomen, after having been distended by gas, is rent about the lower part, and the navel; a sanious, brownish fluid, of a most fetid odour, escapes through the apertures, and there is at the same time disengaged an elastic fluid, very mephitic, the dangerous effects of which are strongly to be feared.

Parent-Duchâtelet remarks, that every year there take place at Paris, in the cemetery of Pere-la-Chaise, nearly two hundred exhumations, to transport into lands acquired by the families, or into proper sepulture, the corpses which had been provisionally buried in the private trenches. These exhumations take place at all times of the year, two, three, or four months after death, often much later. One can conceive that putrefaction is at that time in all its activity, but nevertheless, it has not yet been found that any, the slightest accident has happened to the gravediggers employed on this work, which is the more troublesome, and which should be the more dangerous, that they are obliged to respire in the same ditch the emanations which have been confined there a long time in a narrow space.

As regards the manner of performing exhumations for judicial purposes, and the precautions necessary to be taken, we must, says M. Orfila, make a distinction between a case in which a corpse is simply being removed from a particular trench, and that which intends to cause the evacuation of cemeteries and sepulchral vaults, or the extraction of a corpse from a common trench.

Although there is really no danger in the extraction of a corpse from a private grave (*fosse*), it is nevertheless proper to take certain precautions, if it were only to diminish the inconveniences of the operation. This should be performed in the morning, particularly in hot weather; several workmen should be employed, so as to finish the work as quickly as possible; the grave and coffin should be sprinkled with chloride of lime; but M. Orfila recommends that none should be sprinkled on the corpse itself, the essential conditions of which might be considerably altered by such application. The necessary researches should be made as soon as possible after the corpse has been extracted from the coffin, for contact with the atmosphere accelerates rapidly the decomposition.

Exhumations for emptying a cemetery, or which require excavations, demand much more rigorous precautions than the above. If one is free to choose the season, the coolest weather should be selected, and the operation should be suspended if the weather becomes hot, and the wind blows from the south. As many workmen as possible should be employed, and any gravediggers that become affected should be forthwith replaced. The clothes should be changed every other day, and carefully aerated.

The instruments should be provided with long handles, so that the gravediggers should not be obliged to bend forward. The soil should be well sprinkled with chloride of lime.

If the men are forced to enter a cave or pit, a current of air must be previously carried through it, by means of a lighted stove or some similar means.

The safety of the confined air there must first be ascertained by putting down a lighted candle, and no one must enter if the candle does not burn as it would in the open air. The first workmen who descend should have a handkerchief, steeped in vinegar, applied to their mouths; they should be suspended by a cord, passed under the arms, so as to be drawn out quickly in case of danger.

Solution of chloride of lime should be spread about in the pit.

The same precautions should be used in removing a body from a common trench.

Candle making.—Regulations in force in France.

CANDLES are manufactured in two modes, by dipping, or by running into moulds.

Mould candles are made by running the tallow, sufficiently melted, into tin or glass moulds placed vertically in a frame, and in which moulds the wick has been placed.

Dip candles are prepared by passing the wick at first two or three times over a bath of melted tallow, afterwards plunging it into the bath enclosed in a framework of wood, and replunging it several times, allowing the tallow to run off and harden, until they have acquired sufficient thickness.

Candle manufactories have nothing insalubrious about them, but they give off an insipid and sickly odour extremely disagreeable, and are liable, besides, to great danger from fire. They are therefore placed in the second class of insalubrious works.

No establishments for melting tallow should be permitted elsewhere than in suburban districts; they ought not to be tolerated in towns. If the factory is close to an inhabited place, a street, or a promenade, no authority will be granted except on condition of surrounding it with a wall 8 or 10 metres in height, without any door, window, or opening, on the side of the street or promenade. Provided, however, the locality chosen be proper, manufactories of candles present neither danger nor serious inconveniences.

The Central Board of Health of the Département du Nord has decreed:—

1. That all boilers used are to be surmounted with a hood for conducting the vapours into the chimney.
2. All tallow made use of to be purified beforehand.
3. To place the boiler used in melting in another locality, that is, not in the same chamber as the hearth and cinder holder.
4. Interdiction against using presses for graves (animal fats).

On the manufactories of Prussian Blue, classed in first division of insalubrious establishments.

THE manufacture of Prussian blue, so much used in the arts, may be accompanied by grave inconveniences and real danger if old processes are employed. At the present time, remedies for these inconveniences and dangers are known.

All organic nitrogenous substances may serve for the preparation of Prussian blue. Those ordinarily made use of are, dried blood, horns, horses' hoofs, leather heated in a crucible, with an eighth of its weight of potash and a little iron filings. When all these ingredients are converted into a paste, they are removed with an iron spoon, and thrown into hot water; violent detonations then take place, which might prove dangerous for the workmen if the boiler was not covered with a dome of sheet iron, presenting an aperture only large enough to admit the spoon. The liquid, after boiling a sufficient time, is filtered through linen, and the residue being lixiviated anew, all the liquids are mixed together, and precipitated by a solution of a mixture of sulphate of iron and alum. When the lixivium of fresh blood is mixed with a solution of sulphate of iron and alum, a large amount of sulphuretted hydrogen gas is liberated, which might give rise to accidents; but D'Arcet has proposed an apparatus which prevents all such accidents. It consists of a large barrel, closed by a cover, provided with a funnel through which the liquids can be introduced, and an agitator or stirrer fastened by means of a leather or bladder to put the whole in movement; lastly, a pipe intended to conduct the hydro-sulphuric acid gas as it is generated into the fire-box of a furnace, where it is completely consumed.

All the inconveniences disappear if another process is followed; this consists in employing ferro-cyanide of potassium, a salt containing no sulphur.

The Boards of Health only authorize manufactories of Prussian blue on condition that all the flues and chimneys of the boilers communicate with the chimney, 15 feet in height, of the calcining furnace, and that the waters of lixiviation of the manufactory shall not remain either in the culverts, trenches, or public ways.

On the Hygiene of soap boiling.

THE fabrication of soap is not of itself very insalubrious.

If it finds a place among the classed establishments, it is only in the third class, and that is on account of the lixivium and the disagreeable smoke that it gives off. But there is one very important point as to the salubrity of soap factories, viz., the nature of the solid and liquid residues resulting from the manufacture, and which, easily decomposable, may give rise to considerable disengagement of infectious vapours and sulphuretted hydrogen gas. These different circumstances give peculiar interest to the hygienic study of soap works, and justify the details about to be entered into.

The Councils of Public Health of the Bouches-du-Rhone and the North, in which this manufacture is largely carried on, have brought to light many important elements for this study.

A soap factory comprises three distinct parts: the first consists of trenches or basins, known in the south under the name of *barquieux*, where the carbonate of soda, the lime, and the water for dissolving them, are placed.

The second comprehends the boilers, from five to six metres in depth, built in hewn stone, at the bottom of which is the hearth.

The third consists of chambers called "*mises*," intended for cooling the paste.

The following are the functions of these three parts:—The soda mixed with the water and lime in the *barquieux* gives rise to a solution, which, by means of a conduit, is conveyed into the boilers placed opposite each other. In the boilers is placed the oil, which, by its mixture with the soda, yields soap after a sufficient boiling. When the materials have attained the required consistency, they are withdrawn from the boiler, and placed in the chambers or "*mises*," where they are cooled.

Besides the three portions just described, there exists a supplementary part, which, as far as respects public health, is that upon which attention should particularly be fixed. When the matter placed in the boiler has undergone a first boiling, the workman withdraws from the surface the portion that is ready for furnishing soap, and carries it into the "*mises*," where it is to cool. The residue of this matter, in which are the elements of soap not yet separated, is submitted to more boiling, by which these elements are then extracted.

This second operation gives rise to a last residue, which is called lixivium or "lessive" reboiled, and is of no known use. This lessive has a disagreeable, if not a noxious odour. At Marseilles,

it is run into the sea by subterranean canals, and, without any doubt, it is not the slightest cause of the insalubrity of that port. In other places this lixivium is enclosed in stone pits placed five or six metres below the level of the soil. These basins should be hermetically sealed, and the masonry forming the walls should permit no infiltration to vitiate the springs or waters of the neighbourhood.

Under all circumstances, the solid residues arising from saponification should always be placed provisionally in covered sheds, so that rain waters cannot have access to them and spread them on the public highways, and the liquid residues should be carefully collected in a pit or in a perfectly air-tight recipient, to be emptied occasionally.

As to the smoke and the thick and nauseous lyes which are produced during the process of saponification and the drying of the paste, it is of importance to prevent their dissemination in the environs of the factories, either by combustion of the vapours or by their expulsion through very lofty chimneys.

There is one other peculiarity which should not be passed over in silence, since it concerns the life of the artisans employed in stirring the paste in the boilers. In some works there has been danger of the workmen being precipitated into the boilers of boiling lye. M. D'Arcet has proposed employing a strap and suspension cord fixed to a bar of solid iron, which would be a safeguard to the workman; this is a precaution which should be by no means neglected.

On tallow melting, with suggestions for improving the usual processes.

THE commerce of tallows has lost much of its ancient prosperity; the progress of industry, and particularly the discovery of carburetted hydrogen gas, as a method of lighting, have singularly confined the consumption and production thereof.

The tallows extracted from animals are either melted in vast stoves, which, placed in the open air, contain as much as 7,000 kilograms at one time, or they are melted by chemical means in closed vases. The first method is very simple: journeymen melters stir the material with a species of ladle, $2\frac{1}{2}$ metres long, during the boiling, in order to prevent any portion from adhering to the boiler. A vapour, heavy and nauseous, rises above the boiler; it spreads its fetid odour as far as the outskirts of the abattoirs, and causes frequent complaints on the part of the neighbours, who forget that they came to fix their abodes in the vicinity of the melting houses long posterior to the establishment of the abattoirs, for the police ordinances have long ago forbidden tallow melting to be carried on elsewhere in Paris than in the abattoirs.

The melted tallows naturally leave a residue, which is made to undergo great pressure under a powerful press, so as to extract all the grease.

The residue of this is known by the name of "graves," and is sold for the food of pigs and dogs, and may be advantageously employed as manure.

The second method of melting tallow is that which is performed by chemical processes in closed vessels. This method excludes the production of graves, which is composed of the débris of flesh attached to the fat. In this case, there are introduced into the vessels intended for the melting acids which change these particles of flesh into fat, so that the melting only produces tallow without residue. The tallow melted in closed vessels, by this method, has less odour than that melted in open boilers; the acid modifies the nature of this odour, which at first was not unwholesome in spite of its disagreeableness; but thus modified, it assumes, according to M. Bizet, a truly insalubrious character, although it is less nauseous to the smell.

According to this author, the workmen employed in this latter kind of work experience pains in the chest, with a feeling of illness that they do not suffer from while melting in the open boilers.

Many methods have been proposed to destroy or carry off the odour of the vapours of tallow; sometimes chloride of lime has been used, sometimes a ventilating flue, sometimes pipes for conducting these vapours into the furnace in order to consume the inflammable matters they contain; lastly, it has been proposed to use autoclave boilers. Of all these methods, some are insufficient, others only feeble palliatives, while others present in their application dangers which prevent their use.

The most certain mode of not presenting incommodious vapours would be to avoid the production of any vapours. It is with this object that M. Delunel proposed the heating the raw tallow in a water bath. The advantages which he describes as resulting from the use of his process, are to furnish a finer quality of tallow, to avoid all danger of fire, and to give off no insalubrious odours. Unluckily his process has not been able to be put into execution profitably; for although tallow melts considerably under the temperature of boiling water, it requires a much higher temperature to permit the fatty matter to break by its dilatation the cellular tissue in which it is enclosed, and which imprisons it. We owe to M. Darcet, whose name is attached in so honourable a manner to all questions relating to industry, the knowledge of a process of open fire melting, which presents the fewest inconveniences. M. Darcet's Method.

This process consists in introducing the raw tallow, cut into small pieces, into a boiler of copper, and to heat it there in contact with a certain quantity of water and sulphuric acid.

The proportions recommended by M. Darcet are as follows:—

Tallow		100 parts.
Water		50 „
Sulphuric Acid	- -	1 „

The quantity of sulphuric acid may vary according to the nature of the fats to be melted.

This process presents, according to the author, great advantages in various respects. Although there are still sebacie vapours given off, they are less strong and are modified by the action of the sulphuric acid; the tallow being produced at a less elevated temperature, preserves a great whiteness, and acquires more firmness on cooling than in the ordinary process. The action of the acid seems to have specially for its object to react chemically on the cellular tissue, and, consequently, to facilitate the exit of the fatty matter which it envelopes. The graves dry better than by the old method. One hundred parts of raw fat leave but eight parts of graves by the acid process, whereas the same quantity leaves fifteen by the old system.

The graves press, so largely employed, becomes almost useless by the use of the acid.

The adoption of the process of M. Dareet is, therefore, a most valuable improvement in the melting of tallow. Nevertheless, this process is not free from odour.

To get rid of these incommodious vapours two means present themselves: one to cause them to be consumed in the fire-place, the other to direct them into the drains, as has been proposed at Nantes; but, besides the inconvenience of interfering with the operations, of increasing the cost of the apparatus considerably, as the boiler must be closed and provided with tubes, the first method would render it liable to explosions, by the obstruction of the pipes, or to fires by the communication of fire to the boiler through the pipes; the other method could not be applied in all localities.

The cause of the odour is evidently the long boiling to which the fat must be submitted in order that the cellular tissue should yield all its grease. In searching for methods of ameliorating the processes of melting tallow, sufficient attention has not been paid to the causes which determine the production of the infectious vapours. If the existence of the cellular tissue necessitates the prolongation of the boiling process to permit the escape of the whole of the grease, the method of hastening this melting would be, it appears to us, to break up the cells before the application of the heat, and, to effect this, *the fat should be previously chopped very much finer*. This method, inducing an easier melting, would avoid a great proportion of the vapours which are given off, and even might, in some cases, dispense with the use of the acid, which causes the loss of the value of the graves, and which (acid process) cannot be carried on in the brass boilers which are now in general use. If, by means of suitable apparatus, the cellular tissue can be economically broken up, no doubt but that it would be useless to prolong the melting in order to extract all the grease, and the press alone, after the application of a temperature of 100 Centigrade (212° Fahr.) obtained by water or steam, would doubtless suffice to extract all the tallow, in taking care to facilitate the running off of the melted portions.

Tallow melting is one of the manufacturing operations the most disagreeable, by the infectious and irritating smell which commonly results from it, and which is conveyed to great distances; the

decree of the 15th October 1810, has ranked tallow melting among the insalubrious fabrications of the second class, on account of the incommodious smell and dangers of fire resulting from it. As the consequence of this classification, the banishing from dwelling-houses is not rigorously necessary, but the setting up of tallow-melting establishments is submitted to a previous examination on the part of the authorities, to make certain that the operation, as it is proposed to carry it out, is not of a nature to inconvenience the proprietors of the neighbourhood, or to cause them damage.

It was, however, soon discovered that the nuisance to the neighbourhood of these works was far too great to tolerate their existence in the outskirts of towns; therefore we find in the general statement of the dangerous, insalubrious, or incommodious establishments, drawn up in 1826, by order of the Minister of the Interior, the melting of tallow *by the open fire*, as it is generally practised, ranked in *the first class of insalubrious fabrications*, while the melting by water bath or by steam is retained *in the second class*.

But, as laws cannot have a retroactive effect, the result has been, that, at the present time, we have a great number of melting houses in the towns, authorized in virtue of the decree of 1810, or the existence of which was anterior to this date. The inconvenience caused by these establishments, especially when on a large scale, is such that it has been considered already sufficient to give rise to two ordonnances, one of 20th February 1821, which suppressed a melting establishment at Rouen, and the other of 17th October 1826, which did the same at Mans; and, in these two cases, from the time that our legislation on unwholesome establishments exists, the Council of State has considered the inconvenience sufficiently serious to the public health and the general interest to call for the suppression of establishments that had been authorized.

On the health of the workmen employed on mother-of-pearl shells, buttons, and fans.

THE shells of nacre, or mother-of-pearl, serve for the manufacture of a number of objects of utility and luxury, such as buttons, double and simple, fans, accordion notes, and many fine objects for the table.

This employment is very widely spread, particularly in England, Germany, and Holland, where it occupies a very considerable number of artizans; in France it is carried on only in Paris and some few departments. In the department of Oise, however, several thousand men, women, and children are employed in it.

The pearl shells employed in this work are of three varieties, called in commerce mother-of-pearl, from China, bastard mother-of-pearl, from the Red Sea or Egypt, and lastly, that from Panama. The first variety bears the highest price, especially for fans; the other two are used principally for buttons and objects for table use.

Working these shells into fans and buttons necessitates very different operations, amongst which are some that operate injuriously on the health of the operatives.

To make a fan, a shell must first pass through the hands of the sawyer, then successively through those of the "émeleur," the dresser, the fashioner, the engraver, the cutter, and sometimes through those of the gilder.

To become buttons, the shell passes through the hands of the cutter, the scaler, the turner, the "émeleur," and the piercer.

Each workman has his own special work, and is constantly employed on the same kind of work.

Of all these works, the operatives only complain of the sawing, the grinding (émeleur), and the work "au tour," i.e., the turner's work. These are, in effect, those which present the greatest inconveniences for the health of the workmen.

The *sawing* necessitates a considerable expense of muscular force, a permanent vertical position, and a continual movement of the body on the part of the workmen so as to saw the pearl shell fixed in a vice. In addition, the sawyer constantly breathes a considerable quantity of dust, which each cut with the saw causes to fly towards his face.

The second operation, called *émeulage*, or working at the grindstone, consists in polishing that portion of the shell sawn off, on the mill. The mills employed are of the diameter of $\frac{4}{10}$ or $\frac{5}{10}$ of a metre; they are raised on buckets half full of water, the grindstone dipping a third of its diameter in it. The grinder, placed in front of the stone, puts it into action by means of a pedal; he places on the surface the object to be ground, which he holds firmly in pressing strongly, sometimes with one hand, sometimes with both at once. These inconveniences M. Jorrand sums up to be: *standing always on the same foot; continual movement with the other; continued efforts of pressure, except the interruptions necessary for the inspection of the article, and for changing the object to be ground; heat of body, resulting from fatigue and continuity of work, icy coldness of the hands, which are always wet; together with incessant respiration of watery vapour, mixed with dust.*

Engraving, cutting, and fashioning likewise disengage much dust, but in smaller quantities, and in a way less injurious to the workmen than the other kinds of work.

To cut the buttons, the tower in the air is made use of. A horizontal tree is put in rotation by a wheel moved by a pedal; the free extremity of the tree is armed with a *fraise*, or little circular saw, of the diameter of the button required, and resembling the crown of a trephine. *This work, says M. Jorrand, is extremely fatiguing, and requires force. The workman bends forcibly the elbows, and leans forward the upper part of the body, which causes his mouth to be in front of a thick cloud of dust of mother-of-pearl raised by the round saw or fraise.*

The above are the occupations which in the manufacture of objects of mother-of-pearl more particularly affect the health.

The disengagement of dust and working at the grindstone are therefore the two great causes of the maladies which may affect the workmen.

This dust, of a yellowish white colour, is exceedingly abundant; it is very light, and composed of small grains, excessively thin, which give to the touch a rough and sandy sensation. As soon as one enters a workshop where five or six cutters are working, you are suffocated by this dust, and feel a slight smell of animal matter. This odour is due to the composition of the shells, which enclose an organic animal matter, more or less abundant, according to the age of the mollusc, &c. The fibrous and nacreous structure is that part which generally contains most animal matter, and consequently gives off most of the dust. This explains how it is that the water in which the grindstone bathes becomes so quickly putrid, and renders the work of the mill still more insalubrious.

Chronic bronchitis, hemoptysis, ophthalmia, and cracks in the hands are the maladies which particularly affect the workmen. The thin and abundant dust which escapes from the shell when being sawn, and while being worked on the mill or stone, evidently causes these affections of the organs of respiration and sight. Completely inert, this dust enters into the ramifications of the bronchi, but seldom into the smallest of them, and produces in them an irritation which augments the mucous secretion; the mucous membranes thicken, and cause, especially in the morning, and sometimes during work, a very exhausting cough, followed by considerable expectoration. Chronic bronchitis, frequently complicated with hemoptysis, and still more frequently with pulmonary emphysema, quickly ensues.

The women, who are mostly employed in engraving fans, and placing the buttons on cards, suffer much from chlorosis and similar anæmic complaints, but this depends much on their bad sanitary state, and on the sedentary nature of their employment.

The workmen do not appear to be more subject to phthisis than others, but they are very liable to chronic troublesome asthma, which does not leave them even after their change of employment.

Most of them are not sober, taking a considerable amount of spirits.

The best way to diminish the amount of mischief caused by the inhalation by the mouth and eyes of so much of this sharp dust is to cause currents of warm air to be directed strongly through the workshops of the turners and those who work at the mills and grindstones, and to cause the sawyers to work under a shed, but in the open air. The number of men working in the same chamber should be very limited.

The water in which the stones dip should be frequently renewed, indeed daily, so that the grinder shall not constantly have his hands wetted with stagnant water, and the face continually plunged in a cloud of infected vapour.

The use of masks of very fine silk, recommended and employed in several analogous works, will be very useful to the artizans.

On the laws regulating cowkeeping, &c., in Paris.

THE establishments for keeping milch cows, goats, asses, and at former times, pigs, poultry, and rabbits, in towns containing more than 5,000 inhabitants, are looked upon as inconvenient establishments, and placed in the third class. They have continued, especially in Paris, to be objects of assiduous surveillance, which is not only justified from reasons of public health, and of convenience to the neighbourhood, but which is imperiously commanded by a more considerable interest, the health of the animals themselves, and consequently, the good quality of their alimentary products. It is on this account that the Council of Salubrity of the Seine has frequently had to occupy itself with the numerous cowkeeping establishments spread over the town, the faubourgs and the suburbs.

This branch of industry, regularly looked after by the administration, has arrived, in regard to the public health, at a point to leave almost nothing to desire for the good condition of the stables, and the free escape of the waters.

The complaints against this sort of establishments become each day more infrequent; but some few still are deficient in their arrangements, and the milk furnished from these partakes of the faults of the stables.

Thus, they place sometimes in stables far too small such a number of cows as ought not to be admitted even into much larger stables. It is easy to conceive, therefore, that cows which never leave the cloaca where they are placed, breathing only an impure atmosphere, often badly fed, and still worse attended to, cannot furnish milk of good quality. To obviate this grave inconvenience, the Council of the Seine has thought that it should encourage the formation in Paris of larger and more numerous "vacheries," and submit all those that exist in the rural communes of the department to the surveillance that the administration exercises over those in Paris itself.

The old ordonnance of police on these establishments having been submitted to the revision of this Council, its different articles were examined with great care; the measures prescribed for cleanliness appeared satisfactory; but it did not equally approve of the dispositions relative to the dimensions of the stables, the influence of which on the health of the cattle, and consequently on the nature of the milk furnished by them, is incontestable.

Thus, experience has shown that all that was ordered for the aeration and the ventilation of the stables, was rendered completely useless by the keeper, who, knowing that heat favours the development of milk, shuts, as he chooses, all the apertures through which air could enter; so that the cattle fixed in one spot, lived in a species of stove, where they breathed only hot air more or less altered in its composition, and infected by putrid miasmata.

This accumulation of heat, the deficiency of ventilation in the stables, and the sedentary lives to which the cows were submitted, gave rise to the development of frequent maladies, amongst which

should be reckoned in the first rank pulmonary consumption, and acute and chronic inflammation of the lungs.

To obviate, as completely as possible, so serious an inconvenience, the Council has decided that it would only authorize the establishment of *vacheries* in very open and spacious localities, at the same time, fixing in an invariable manner, the number of cows permitted to be kept there.

Therefore, it proposed to exact, in future, the following conditions:—

1st. The stables for cows not to be less than 4 metres in height.

2d. The stables for one row of cows not to be less than 4 metres in breadth from the manger to the opposite wall.

3d. The stables for two rows of cows not to be less than 7 metres in width, from one manger to the other, if the mangers are placed against the walls; and not less than 8 metres if the mangers are placed in the centre of the stables.

4th. The space reserved for each cow not to be less than 2 metres in breadth.

Lastly, the Council has decided that it was necessary to determine positively that no cow establishment situated lower than the surrounding soil should be authorized, and that authorization should always be refused when it is sought for in a locality where the waters which drain from the stables are to be received into cesspools.

These wise regulations have been confirmed by the ordonnance of police of 27th February 1838, which has completed those of the 12th June 1802, and 25th July 1822.

ORDONNANCE No. 1,646.

Paris, 27th February 1838.

We, Prefect of Police, ordain:

1. In future no cow-keeping establishment to be opened in Paris, except in localities situated between the surrounding walls and the lines directly to be mentioned, namely:

On the left side of the Seine.

The esplanade and the Boulevard des Invalides; the Boulevard of Mont Parnasse, &c. &c.

On the right side of the Seine.

The Allée des Veuves; the Streets d'Angoulême, Pepinière, Saint Lazare, Coquenard, Montholon, &c., &c.

2. The stables to be paved sloping; they must be provided with a stream of water, to facilitate the running away of the liquids.

3. The purveyors to cause the dung to be removed at least once a week, before 6 a.m. in summer, and 8 a.m. in winter.

4. The flooring of the stables to be made a smooth surface.

5. The forage stores to be separated from the stables by a wall in masonry, if they are placed on one side, and by an area pugged with plaster or brick pavement, if the stores are above the stables; in no case can any grate, stove, or fire-place be erected in the store-rooms of the forage.

6. The purveyors to keep the cows in the most perfect state of cleanliness; they are to conform to all the precautions for salubrity prescribed by the permission with which they must be provided, conformably to the regulations for dangerous, insalubrious, or inconvenient establishments.

7. The purveyors are expressly prohibited from placing malt in any cellar under any pretext whatever.

They may only deposit malt in excavations constructed on purpose, under sheds provided with skylights, and in well-lighted places.

These places for depositing malt may only be used after direct permission of the administration.

They must remain constantly open; the malt alone may be covered over with straw or some other substance for preserving it in good condition.

8. The ordonnance of police of the 25th July 1822 is repealed.

G. DELESSERT.

On the physical changes produced on the limbs of bleachers of wool.

IN the manufactories where tissues of wool are bleached by means of the vapour of sulphur, as in that of M. Vérité, at Courbevoie, near Paris, the workmen employed in drawing out the pieces which roll from between the cylinders, have their hands in a peculiar condition.

The skin first becomes softened by the frequent contact of sulphurous acid; the epidermis, completely blanched, is wrinkled, upraised, and destroyed in places. This disposition is most particularly marked on the thumb and index finger, because these are the two fingers which seize and stretch the material.

It is seen on both hands to an equal degree, because the workman uses both equally, in order that those fingers of the right hand may not be too deeply and severely injured.

On the Police laws regulating the trade of bakers in France.

IN France, for a long series of years, regulating the commerce of bread has excited the solicitude of the Government, which has endeavoured to ensure the constant sale of bread at a moderate price, by subjecting this branch of commerce to a very strict system, and to a special surveillance.

The end to obtain in this matter is the constant provisioning of every locality, in conjunction with salubrity and unadulterated products. We propose to show by what conditions this result is obtained, or, in other words, what is actually the régime of the bakers' trade, as well in France as in foreign countries.

The freedom of trade, substituted by the revolution of 1789 for the privileges of corporations, extended to bakers as well as other traders. But on the 19th Vendémiaire, year X., the Consular Government, desirous of facilitating the surveillance of the bakers of Paris, some of whom had, under serious considerations, threatened to close their shops or refused to bake the same quantity of bread as heretofore, and anxious to ensure more fully the proper provisioning of the city, published an order which established the following conditions, to be obeyed by all members of that trade :

1st. Obligation to obtain a special provision from the Prefect of Police.

2d. Deposit in a public magazine, of fifteen sacks of flour of the first quality, weighing 159 kilograms.

3d. Private and permanent provision of sixty, thirty, and fifteen sacks, according to the relative business of each baker.

4th. Nomination of four syndics, charged with the surveillance and the administration of the dépôt.

5th. Granting a patent to each baker as an encouragement.

6th. Prohibition to quit the trade without giving six months' notice.

7th. Prohibition to diminish the number of ovens without authority of the Prefect of Police.

8th. Infringement of any of above rules, to cause baker to lose his licence.

9th. The dépôt of guarantee to be forfeited if baker quits his profession without permission.

This order of the year X. has remained the basis of the régime of the bakers in Paris to the present day. It did not limit the number of bakers, which, however, in consequence of the obligations imposed by it, has become gradually reduced and has remained limited, for twenty years past, to 601 establishments actually existing.

Various modifications have been successively introduced into the police laws of the trade; the principal relating to the provisioning.

By the last police regulations (May 1848), the Paris bakers are obliged to keep a total amount of 128,583 quintals of flour of the finest quality.

This corresponds to a consumption of about thirty-two days.

The keeping up a store of flour at their own private shops being very likely to become incomplete, in spite of the surveillance of the authorities, and a delay in the arrival of flour on account either of drought, or of floods, or frost, being liable to cause much mischief, it was thought necessary to guard against such accidents, and such is the object of the Ordonnance of 19th July 1836, which obliges bakers to deliver into a public reservoir which is

loaned to them gratuitously for this purpose, three-fifths of the store of flour which they ought to have constantly in their possession.

Ordonnances of police had introduced many restrictions to the sale of bread in the Paris markets; that of the 19th November 1828, removed the whole of these entirely, and has allowed the bakers both of Paris and the suburbs to bring and sell bread every day, in all the markets, and in any shape they may choose.

Bread is sold there, of similar qualities, $2\frac{1}{2}$ centimes per kilogram under the tariff price, and it has been remarked that this trade, so useful to the poorer part of the population, acquired considerable extension during the high prices of 1847, since the sale of the suburban bakers alone, in the Paris markets, which in 1845 only amounted to 5,760,349 kilograms, were 6,871,425 kilograms in 1846, and in 1847, 8,139,606 kilograms; the amount fell off again in 1848 to 6,286,702 kilograms, and to 6,354,639 kilograms in 1849.

In 1847 there were 42,628 bakers in the whole of France, that is to say, one baker for every 830 inhabitants.

Baking houses do not figure, and properly so too, among the classed establishments, and the influence of the manufacture of bread affects no others than those actually employed. The Council of Salubrity of the Seine, however, has had to consider several questions relating to baking, questions of general interest. It was of importance in the first place to ascertain if the use that the Paris bakers make of leaden cisterns, to preserve the water employed in making bread, could give rise to accidents, and whether the use of these reservoirs should be interdicted, or whether it might be tolerated with certain modifications.

After long continued and decisive experiments, the Council has determined formally that the bakers may be allowed to continue to use leaden cisterns, on condition that they place the tap at a distance of three inches from the bottom of the cistern, in order that the insoluble carbonate, if any be formed, may deposit itself at the bottom, below the tap, and also on condition that they cause the cisterns to be cleaned out once a month. For further security the Council has considered it necessary to require that the sheets of lead which line these reservoirs should be covered with a slight coat of varnish, so as to prevent the contact of the lead and water, and prevent the formation of insoluble carbonate of lead. To apply this wax, it will suffice to warm the lead gently, to rub it rapidly and several times with a piece of wool covered with wax.

The second fact relates to the use of copper scales for weighing the dough with which the bread is made. A report of the inspector of bakers of Paris has caused it to be known that in 559 out of the 601 baking houses that exist in Paris, they employ copper scales to weigh the dough, and that these scales, instead of being cleaned with linen, as might be supposed, are cleaned by the chains which suspend them, being used as a brush. The Council saw the danger of this custom. In truth, the dough,

composed of water and flour, and containing, besides, a certain quantity of salt, attaches itself to the plates of the balance, and exercises on the metal a chemical action, resulting in the formation of oxide of copper. This oxide, or the salts of copper so formed, then penetrate the portion of the dough which, later, is detached by the friction of the chains. It is easy to conceive that in this case, oxide of copper may be introduced into the bread, and that it is of importance, in the interest of the public health, to take measures for preventing, either through neglect or imprudence, bread that contains even very small quantities of salts of copper being distributed for consumption. The Council has considered that it would prevent all such danger,—

1st. By obliging bakers to use balances whose scales should be of tin plate;

2d. By ordering the scales to be cleaned by means of a rubber made with tinned iron, and used for this purpose alone;

3d. By obliging them to wash these rubbers with hot water;

4th. By prohibiting bakers from using in their shops utensils of copper, brass, or zinc;

5th. Lastly, by ordering bakers, if it is thought inadvisable to impose on them the execution of the measures indicated by Nos. 1 and 3, to cover solidly with tin the chains and scales of their balances, and their utensils of copper, brass, or zinc.

Two more points deserve all the attention of hygienists and government officers. Generally speaking, the bread is made in cellars, narrow, badly ventilated, and impossible to be kept clean. The walls are frequently in a state of dilapidation which offers shelter to a crowd of insects, which are often found again in the bread. The kneading done by the hands of men, has, besides, something very repugnant. And on these two points it would be very desirable that the influence of authority should hasten to propagate improvements already accomplished in this art.

The profession of baker, known generally as a very unhealthy one, is, however, less so than it has been said to be. The bakers' assistants, divided into "*brigadier*" who shapes and places in the furnace, into "*geindre*" who kneads, and into "*aide*" or assistant, who heats the ovens and helps the principal workmen, are exposed, some to the excessive heat of the furnace, others to the very severe labor of working the dough, and to the dust given off from the flour. The operations of bakers take place at night. And without taking into consideration any influence that a night life may exert on the physical and moral constitution of man, an influence reduced to its just proportions by Mr. Turner Thackrah, we cannot but acknowledge that there are objections to the great changes of temperature, which must be felt after his work at the oven, or after kneading, by the workman who exposes himself to the morning's cold. Rheumatic affections, and acute inflammations of the chest, are in fact, as Ramazzini had already pointed out, those which most frequently attack bakers. In a report of the Institute of Hamburg, quoted by Thackrah, it is stated that acute rheumatism attacks one sixth of the bakers, while it only shows itself in one fifteenth of the

tailors. Every one also has remarked the pallor so strongly characteristic of baker's journeymen. It must be attributed particularly to that anæmic condition peculiar to all artisans who live in a very hot atmosphere. This influence, in conjunction with the smell given off by heated paste, doubtless contributes to predispose bakers to dyspepsia, which frequently, also, the habits of drunkenness and disorder, well known to be common to them, determine.

The dust of flour which penetrates into the air cells of the workmen, does not exert the disastrous effects which have been assigned to it; and the statistics of M. Benoist de Châteanneuf, and M. Lombard, of Geneva, have demonstrated that this profession is not decimated, as has been stated, by consumption.

The former of these authors has observed, that out of 2,800 bakers deceased in ten years, fifty-seven only died of tuberculous affections. The irritating matters mixed with the flour, such as remains of insects, different pellicles, perhaps also the contact of the yeast, cause a squamous eruption to show itself on the hands, which Ramazzini perhaps had in view in describing the thickening of the hands of bakers, and which is referred by Thackrah to a species of psoriasis. This affection is very distinct from the muscular development caused by the operation of kneading the dough.

These observations on the hygienic influence of the profession of baker, hardly allow us to specify to what special cause was due the frightful mortality which ravaged these artisans in the plague of Venice, according to Mercurialis, and in that of Marseilles, in 1720, which carried them off in mass.

It is difficult not to think that some local influence, or some unperceived coincidence, could alone explain this extraordinary fact. This opinion would be confirmed by the observation of what occurred in the first cholera epidemic in Paris, where the bakers figured only to the number of ninety-six in the table of deaths, a proportion very inferior to that of a number of other professions understood to be much more salubrious than that of which we are now treating. We must also count as due more to imprudence than to the necessities of bakers' work, the possibility of asphyxia, from the vapours of ill-extinguished coke. The most simple precautions will suffice to avoid all accidents of this kind that may have occurred.

Indeed, the greater part of the inconveniences to which bakers are liable, may be removed by putting into general use the improvements lately discovered.

On the diseases of workmen employed in the manufacture of tobacco.

NICOTINE is the active principle of tobacco; it appears to exist in it in a state of combination.

Fermented tobacco contains less of it, although it smells more; it is because a portion of the nicotine has been destroyed by the fer-

mentation ; the ammonia which has been developed has set at liberty a part of the nicotine.

The *nicotianine*, according to the observations of Messrs. Henry and Boutron-Charlard, is a species of solid essence, which owes its properties to its mixture with the nicotine. In snuff, the ammonia is in the state of a salt, the nicotine is partly free, partly in the state of a neutral or basic salt ; it is to these two salts that tobacco in powder owes its power of over-exciting the mucous membrane of the nose. The leaves of tobacco yield from 19 to 27 per cent. of ash, which are generally very *siliceous* ; they contain, in addition, carbonates of lime, potass, and soda, and different other salts.

In France, the culture of tobacco is under certain regulations ; the annual crops amount to about 16,000,000 of kilograms in the departments of Ile-et-Vilaine, Lot, Lot-et-Garonne, Nord, Pas-de-Calais, &c.

Of all the industrial cultivations, the most general in the Algerian colonies is that of tobacco.

In France, the Government, which possesses the monopoly of tobacco, directs from Paris, by its Director General of Duties, the different manufactories in the kingdom ; this central administration has wished, in the interest of the consumers, as well as to facilitate its own labours, that a uniform mode of fabrication, that which gives the best prepared tobaccos, should be adopted in all the establishments, and it is on this footing that they are formed ; there do exist some differences, but these have no sensible results on the products, they arise from the peculiar ideas of the chiefs of the establishments ; but among these differences there are some which may exercise some influence on the health of the workmen, and which it is important to know.

To respond to the ever-increasing wants of the consumers, ten great manufactories are constantly occupied in the manufacture of tobacco ; they are situated in the following towns :—Paris, Lille, Strasburg, Lyons, Marseilles, Toulouse, Tonniens, Bordeaux, Morlaix. In some of these tobacco is manufactured in all its forms ; in the others, they only make cigars, or what are called “ Carottes,” “ rolls.”

This difference should be noted, because it has an important bearing on the health of the workmen.

Medical men are attached to these factories ; their institution goes back to the earliest times of the monopoly, that is to say, 1811. For a long time their duties consisted merely in visiting the workmen, either at their entrance into the works, in order to certify as to their health, and to put aside those in ill health and those labouring under contagious diseases, or during their sojourn in the factories, to give them advice and attention. At the present time, the mission of these physicians is more extended. The administration has increased it by requiring them to transmit, in detailed reports, annually, the remarks which they may have made upon the health of the workmen, upon the maladies observed in the manufactories, and on the peculiarities which these maladies may have presented ; a most excellent measure, which bears witness to

the zeal of the administration for the interests confided to it, and which should be adopted in all establishments which occupy a number of workmen.

This would be the best means of uniting, as to the influence of employments, precise information, information that the science of Hygiène would know how to profit by, and that the legislator himself might usefully consult.

But a short time has elapsed since observations have thus been demanded from the physicians of the tobacco manufactures, and already the collection of their reports present a high interest. M. the Viscount Simeon, director-general of the administration of tobaccos, has drawn up, in a short work, the information furnished by the physician in the course of the year 1842. The principal questions therein examined are three:—

1st. The workshops and their conditions.

2d. The diseases and accidents met with during the year.

3d. The effects of the tobacco on the health of the workmen.

According to the observations made by all the medical attendants, tobacco appears but rarely to produce sensible effects on the workmen, even at the commencement of their work.

There are only two work-rooms, that of the fermentation of the masses intended for the fabrication of the tobacco in powder, and that of the drying of the “scaferlati,” in which the emanations of the tobacco have appeared to exercise any real and durable impression on some very nervous subjects. But the cases are few, and as a whole, the manufacture of tobacco is not injurious to those who work at it. The action that the emanations have exercised on some individuals, develops phenomena more or less intense, but entirely analogous to those produced by an excess in using this substance. Some of the medical attendants assert that the manufacture of tobacco is not only not injurious to the men, but that it even prevents phthisis and other diseases of the chest.

Dr. Melier, who has lately investigated this subject with the greatest care and attention, states that fresh workmen have always some difficulty in accustoming themselves to the atmosphere of the workshops, charged as it is with particles of the tobacco. He states that they experience the following symptoms in general:—a more or less severe headache, accompanied with sickness and nausea; they lose their appetite and sleep, and many of them suffer from diarrhoea.

These effects are more constant with the females than the males, but the former are more in number than the latter; in Paris there being 800 women employed to 500 men.

This sort of acclimatisation for the new workers is always more difficult in summer than in winter, and the hotter the season the more it is painful and long, the heat always augmenting the effects of the tobacco, as Ramazzini had before remarked. Once the first difficulties surmounted, the workmen become habituated to the work and cease complaining; indeed, it seems as if they do not perceive the emanations that surround them. They even appear to like to sleep on tobacco leaves, and the belief is extremely

general among them that the manufacture is favourable to rheumatic pains.

Certain workmen, however, experience a considerable change, which deserves attentive study. It consists in a particular alteration of the complexion. It is not a simple discoloration, an ordinary paleness, it is a grey aspect, with a wan dull appearance, a mixed shade between chlorosis and certain cachetic diseases. The physiognomy receives from it a peculiar character, which an eye accustomed to see these cases can recognise immediately as occurring only to tobacco workmen. This *facies* is only observed among those that have been long at work at tobacco. Dr. Hurtiaux states that it requires at least two years to acquire this countenance. The preparations of iron remedy this condition of things, and restore to the men their original tint.

The diarrhoea so often brought on at the commencement of this work, requires no special remedy, as it is at the same time a symptom and a remedy of the evil.

REMEDIES.

The best methods of remedying the injurious effects which may be caused by the emanations arising from tobacco manufactures appear to be:—

1st. To use that mode of fabrication which causes the least disengagement of dust.

2d. To facilitate, by physical means, the exit from the establishment of the dust which is in the air.

3d. Lastly, not to employ individuals of weak or nervous constitution.

The first end will be attained by causing the tobacco to be worked in a *moist* state; the dryer it is the more dust will be produced. In the month of August 1827, the tobacco was delivered to the workmen of Lyons in a much less moist state than usual; many of them fell ill, and declared that their indisposition was due to this circumstance.

The second end, that of favoring the carrying away of the tobacco dust from the work-rooms, will be secured by the following means:—In the first place, the work-rooms must be large in proportion to the number of men that they are meant to contain, that they must be open from the north to the south, in order that by simple currents of air they may be swept from the dust which collects everywhere, and which would remain there indefinitely, if great care was not taken. This ventilation should be made in the absence of the workmen, and renewed twice a-day; the windows of the work-rooms should be very large, and should reach from the ceiling to the floor. Lastly, the exit of the dust will be much favored in rooms where it is very abundant, by constructing draft furnaces.

It must be owned that the Administration spares nothing in what may concern the interests of the workmen, and it thus succeeds gradually in alleviating the inconveniences to which they are

exposed. For this reason, when M. Chevallier pointed out the danger of using lead to envelope the tobacco, tinfoil was forthwith ordered to be used instead, although this apparently simple change caused a considerable increase in expense.

Tobacco is constantly adulterated with many noxious ingredients, some of which are used to colour false ingredients. Among other substances the following have been detected:—marine salt, sal ammoniac, potass, saltpetre, cream of tartar, honey, treacle, sulphate of copper, sulphate of iron, animal black, sand, alum, fine sawdust, tan, ivory black, dried earth, dried dung, red lead, orpiment, cinnabar, and sulphuret of antimony.

On the health of the workmen employed in the manufacture of sulphate of quinine.

THE preparation of sulphate of quinine has quite recently been the object of very interesting observation, in a hygienic point of view, on the part of M. Chevallier, who has rightly considered that this kind of work, known only the last thirty years, might be the occasion of certain special accidents. On this subject he made numerous researches, and with the assistance of evidence obtained by himself, as well as from correspondents in England and Germany, from the most important manufacturers of sulphate of quinine, he has arrived at the following conclusions:—

The artisans who work at the fabrication of the sulphate of quinine, are exposed to be attacked by a disease of the skin, which obliges them to suspend their work during a fortnight, a month, or longer.

There are some workmen who cannot resume this work, and who are forced to quit the establishments where they have been employed. M. Zimmer, a manufacturer at Frankfort, has found that the workmen who were occupied in powdering the quinquina in his works, were attacked with a peculiar fever, which he designates by the name of “Quinquina fever.”

This disease is so painful, that those workmen who have suffered from it have refused to powder the quinquina, and have preferred quitting the establishment. This complaint has not yet been observed in France. No prophylactic means are known at present for preventing the skin disease. It attacks, however, not only the workmen who are actually employed in various operations connected with the manufacture of the quinine, but also those persons who come into contact with the emanations of the manufactory.

It attacks those workmen who are sober, equally with those who give way to excesses.

It has not been shown that there are any causes that predispose the workmen to be attacked by this disease, although several persons admit predisposing causes.

Although the memoir of M. Chevallier contains an *imposing number* of cases, it has not completely convinced us.

This savant deserves much praise for having directed attention to a question interesting to the health of quinine workmen ; but the greater portion of the facts, which may have some value, emanate in general from persons who are not medical men, as directors of factories or manufacturers themselves. Thus Mr. Henry writes :—

“ I know that the little *scraps* of the barks of calysaya are capable of determining irritations in the dermis and of causing some inconveniences ; but I do not think that they are of the same nature as those remarked in the disease which occupies your attention. This complaint, of which, for my part, I have never had the slightest attack, although I have lived and worked a long time in manufactories of sulphate of quinine, mostly attacks scrophulous or very lymphatic individuals ; it attacks the men who boil the bark at least as much, and more than those who reduce it to powder, and it attacks those who bottle the sulphate.”

However it may be, the principal accidents which may arise from the fabrication of sulphate of quinine, consist in a fever more or less severe, and an exanthem. The fact of this fever arising from the manufacture is certainly proved, but we do not think that that is the case with the exanthem.

Nevertheless, we will add that now that public attention has been called to this point, further observation will demonstrate or invalidate the facts newly studied by our learned colleague.

On the health of the workmen employed in cotton factories in France.

THE Academy of Moral and Political Sciences of the Institute of France, charged M. Benoiston de Châteauneuf and M. le Docteur Villermé to make a series of researches into political and statistical economy in the departments of France, with the view to show, as minutely as possible, the physical and moral condition of the working classes.

The reports on the workmen in cotton, silk, and wool, are those of M. le Docteur Villermé.

Cotton.

One of the most insalubrious parts of cotton factories is that where the beating of the raw cotton takes place. This operation, whether done by hand or machine, produces a thick cloud of irritating dust and of cottony down, which is deposited upon the workmen, dirties them, attaches itself to their woollen clothes, to their hair, their eyebrows, their eyelids, the entrances of their ears, to the nostrils, their beard, wherever hair can retain it, and give them, during their work, a strange aspect.

It finds its way into the nose, mouth, and throat ; and also into the minute ramifications of the air tubes.

This down, or dust, that the beaters raise and inhale in such large quantities, can but exert a most deleterious influence on

their health. It is a point on which there is no dispute in any of the places where cotton is spun.

Not only do the workmen themselves complain of it, but also the foremen, sometimes even the masters, and always the medical men.

This insalubrity is so generally recognized, that in many mills, especially in those of Alsace, where the beating is performed by machinery and employs consequently but few men, the workmen in the carding rooms are successively and in turns employed in looking after the beating, like soldiers mounting guard.

Whether it is the dust in the raw cotton or the down itself which ruins the health of the workmen employed in the beating, it is quite undoubted that their death is certain, proved; that they complain of dryness of the mouth and of the throat, and are seized after a short time, sometimes in a few days, with a cough which becomes more and more troublesome.

I have, nevertheless, seen in some beating rooms, men in good health, who assured me that they could work there several years consecutively without suffering. It is to be remembered, however, that they received very high wages, either directly from the manufacturer or through a small contribution raised on the salaries of their numerous fellow workmen employed in carding, which contribution exempted them from taking their turns in the beating department.

The cough is the first symptom of a slow and formidable disease of the chest, which is always relieved by simple cessation of this kind of work, and which at the commencement is cured by abandoning altogether the beating room.

I have seen workmen who have in this manner suspended and resumed the cough. This disease takes on, during its development, the appearance of consumption, and the physicians of the countries where the cotton mills exist, call it "cotton phthisis," and some "cotton pneumonia." These names are significant. The victims frequently go to the hospital to die, but I have been unable to ascertain the proportion of such. It is especially the women, children, and young persons who thus die, because beating by machinery not requiring muscular efforts, full grown men are never employed at it. When the cotton is beaten by hand or by sticks this is different.

Formerly there was no other means of beating cotton but this latter. But at the present time, in all the mills where they do not manufacture the finest threads (and they are the greater number) machinery has been substituted.

The invention of these machines and their application to the manufactures of cotton and woollen materials, especially the latter, have been a great benefit to the workmen, and the cause of great saving to the manufacturer; for they have permitted, in the greater number of the factories, the suppression of the hand-pickers, of whom there were great numbers, and to diminish, in a very large proportion, the number of workmen employed in the beating.

In order to appreciate this benefit, one should see, in the establishments where cotton is still beaten by sticks, the fatigue of the wretches doomed to this operation. It is much to be regretted, however, that up to the present time (1840) it has not been possible to construct a machine fit for opening and cleaning all kinds of cotton, and that it is always necessary, for fine spinning, to pick and beat by hand.

Insalubrity of the same nature as that caused by the beating, but in a far less degree, menaces the workmen charged with the early operations connected with carding.

This is not the case, however, with the subsequent operations.

It appears easy, at first sight, to remove from this dangerous influence those who are exposed to it, by means of a gauze mask on which the dust and the down suspended in the air might deposit itself at each inspiration. But this deposit would render such a mask more and more impermeable to air, would oblige the workmen to make considerable efforts to breathe, so that in a short time he would throw it aside, and it would not be possible to prevail on him to take to it again.

Very lately the machines for beating and cleaning cotton have been modified so as to work without raising so large an amount of dust and down. I saw at Zurich, at the mills of M. Escher, a work-room of ventilating beaters so modified. To my great astonishment, the face and clothing of the workmen bore scarcely any traces of their occupation, notwithstanding that all the windows of the hall were open. Till that time I had always seen the contrary.

The most unwholesome operation in connexion with the cotton manufacture was thus made healthy. This result ought to cause the universal adoption of that machine. Indeed it is adopted in Alsace, but in no other part of France or in Belgium.

Another cause of insalubrity in cotton mills, but one which acts in a less injurious degree than the preceding, is the high temperature that it is necessary to keep up in several works.

For the carding a temperature of about 60° Fahrenheit is enough.

The spinning requires a higher temperature for the finer threads; without that they would break every instant. A temperature of about 60° or 62° Fahr. is required for the coarser threads; of from 67° to 70° for the middle sizes; and from 75° to 77° for the finest. These high temperatures are as necessary as the absence of every current of air.

The works for printing Indian handkerchiefs, and those for drying the cotton, require to be kept equally warm.

Lastly, the temperature is commonly from 100° to 104° where they dress the cotton by machinery, and from 93° to 104° where certain other operations are carried on.

One must remain for a time in the different rooms where these high temperatures exist to know what amount of inconvenience is experienced there; the workmen, arms, feet, and legs naked, and with but little other clothing on, are constantly in a state of abun-

dant perspiration. It is easily understood, therefore, how easily accidents to health arise, especially in winter.

The women, employed in what is called the "Scotch" department, the hottest of all, appear paler than the others. But if I may believe the proprietor of one establishment, where I saw fifty of these women in one apartment, the only inconvenience they experience is a kind of erysipelas, which develops itself at the bend of the thigh especially in the stoutest, and frequently obliges them to desist from their employment. But, according to the managers of two other similar establishments, many of the women are obliged to abandon the work altogether; and if nearly all of them are between 16 and 25, or 30 years of age at the most, it is partly because the young support this great heat better. On the other side, the physicians of Mulhousen, Thann, Tarare, Saint Quentin, Rouen, &c., agree in asserting that the women in question are oftener than the others attacked with colds and severe inflammation of the chest, in consequence of the sudden changes of temperature to which they are exposed. The drying rooms of these establishments are sometimes heated to a temperature of 122° Fahrenheit, but there are few workmen at a time in those rooms, and they remain there but a short time.

A temperature of above 122° may appear surprising, but Dr. Ure, in his *Philosophy of Manufactures*, says that there are stoves in some of the works which give off a heat of from 140° to 150° Fahrenheit, that is 30° or 40° higher than the temperature of the human body; and he adds, that the workmen, exposed alternate days and in all seasons to so great a heat and to the open air, find in these hot rooms a remedy against the colds which attack them, are in as good health as the others, and are received as members of benefit societies, a proof that their work is not considered unhealthy.

Two kinds of workmen in the cotton mills demand a more particular mention; they are the *fleecers*, and the *sharpeners of the carding machines*, or rather of their points.

Both of these, especially the latter, are said to pursue an occupation very noxious to their health; opinion is unanimous on this point everywhere.

The danger arises from the great bodily exertions they use, and the dust they inhale. The former suffer just as the cotton beaters do, while the latter are injured from the same causes as the polishers of steel.

These are both diseases of the chest, and principally consumption.

It is therefore highly desirable that the fleecing and the sharpening by hand should be displaced by machinery, or at any rate that some amelioration in these operations be introduced.

The beating cotton is therefore the most dangerous employment for the number of persons employed.

On the plantation of trees in the interior of towns.

It is an opinion generally admitted that the planting of trees contributes equally to the embellishment, the charm, and the healthiness of towns. This opinion appears to be solidly founded, as to the question of health, on incontestable facts of vegetable physiology.

This opinion, however, requires to be received with certain modifications, as, unless these plantations are made under certain ascertained regulations, more mischief than benefit will arise from this practice.

After going into many details and discussing many questions connected with the physiology of plants, Dr. Jeannet, of Lisle, sums up with the following

Conclusion and propositions.

1. The plantation of trees in the interior of towns does *not* produce any appreciable improvement of public health. There exists too great a disproportion between the production of carbonic acid resulting from a city life, and the atmospheric purification resulting from the respiration of some thousands of trees planted in the principal streets.

2. *Large trees* planted *too near* houses are a powerful cause of insalubrity. They render the atmosphere in their neighbourhood humid, because their transpiration pours out into the air enormous quantities of water; because they retain the rain waters, which, instead of running rapidly on to the surface of the soil, evaporate gradually in the atmosphere; because they determine during the night the precipitation of the atmospheric humidity under the form of a fine shower; and because this shower, with which they are covered as if it had been raining, returns into the atmosphere in the state of vapour during the day.

Moreover, trees are injurious to the free circulation of air, and they intercept light and heat. This is a very serious inconvenience in the interior of towns, where all the efforts of public administration should tend to favour the penetration of air, heat, and light, even into the lowest habitations and the most remote corners.

For air, light, and heat being the chemical and physical promoters of organization, are at the same time the only true agents of the salubrity of dwellings.

3. Trees planted in the principal thoroughfares as pursued in some of our towns produce only a questionable embellishment; they are in unfavourable conditions for vegetating vigorously; the plantation is continually disfigured by the disease or natural death of a great number of members.

4. Inasmuch as trees are a delightful object at a certain distance from houses, *when they do not cast their shadows on them*, in so much do they become inconvenient and injurious, as a general rule, *when they are near enough to intercept the sun's rays*.

They must be considered as noxious when their distance from the houses does not exceed their height.

5. The following system which I propose will reconcile the interest of the public health with the pleasure of the inhabitants and the decoration of the towns.

Those streets having not less than 25 or 30 metres in breadth must alone be planted with trees. In these streets, the trees will form in the middle of the space existing between the houses an avenue 6 metres broad only.

The trees should be cut away at the height of about 7 or 8 metres; their side branches should be cut away so as to prevent their extending too far, without causing them to become straight lines.

In the streets of 30 or 40 metres in width, like the Boulevards of Paris, the trees should never be planted nearer than 10 metres to the houses; only one row should be planted on each side, and the lateral branches should be directed towards the centre of the street.

Thus the houses should be 10 or 12 metres from the trees; these, being only 7 or 8 metres high, would rarely shade the ground floors, but always the foot-paths.

As to the large spaces, like the quais, the squares, open spaces, &c., I would propose to plant them with trees allowed to grow into their most majestic beauty, compatible with their not being too near to habitations.

I do not think that the lime and the ash trees generally adopted in most places, offer to a sufficient degree the conditions that are desirable for the decorations of towns, viz., a thick foliage, a rapid growth, robust health, and a tap root.

On the best means of ensuring the salubrity of towns.

M. E. CHEVREUL, in a paper read before the Academy of Sciences of Paris, stated that he had proved by direct experiment that wherever there existed alkaline sulphates, together with certain organic matter, in a body of water out of contact of air, a sulphuret is of necessity formed, and that he thus explained the pollution of the waters of the Paris basin, which contain sulphate of lime, as well as of the water kept in oaken barrels for the use of sailors, and the infection of sea water that had penetrated the hold of a ship.

From the decomposition of organic matter, and its accumulation in the soil of populous cities, is derived the cause of the insalubrity and even of the poison that this soil, and the waters of the wells sunk in it, may show after the lapse of a certain time, when the ground, being permeable, is not capable of being always cleansed *per descensum*.

Animal remains buried in the earth, matters escaping from water-closets, privies, and cesspools, organic matter from houses which penetrates the soil, liquids formed in gas pipes by condensation, and escaping therefrom by cracks or badly formed joints, these are some of the causes which give rise to the changeable organic matter which helps to carry insalubrity and infection into the strata which they penetrate.

To this we must add the tendency of a porous calcareous soil to produce nitrates of potass, of magnesia, and especially of lime, under favourable conditions, and a certain proportion of sulphate of lime being present, we shall have all the substances which will produce, with the organic matters, the effects of sickness and disease which would not take place without their presence and intervention. It is particularly the sulphate of lime which gives to the soil of Paris a strongly marked character of insalubrity or infection, which is not remarked in towns whose soil and water are not provided with this salt.

The means to be employed to assure the salubrity of towns are, the one *preventive* only, the others *capable of preventing the insalubrity, and of combating it if it shows itself*.

The *preventive measures* consist in diminishing as much as possible the quantity of organic matter which enters the soil. Such are the establishment of cemeteries and receptacles for sewage at a distance from the towns; the establishment of paved water-closets; incessant washing by means of fountains and water-conduits in the streets; numerous drains and sewers, into which will empty themselves the conduits for water and gas.

The means of preventing the insalubrity and combating it if it exists, are not numerous.

The first of these consists in bringing atmospheric oxygen and light, wherever organic matter susceptible of becoming unwholesome by a commencement of decomposition, exists. The reason for this prescription is the tendency of oxygen to convert definitively all organic matter into water, carbonic acid, and nitrogen, by slow combustion—products perfectly innocuous to the animal economy; and the influence of light is favourable to this tendency. One consequence of this prescription is great breadth of the streets, and a sufficient extent of the court yards of houses, so that air and light may freely penetrate them.

A second mode exists, when wells are sufficiently numerous, and placed in conditions such that the water in them is frequently renewed, because there is a constant demand for that liquid, either for daily domestic use, or to purify the soil from the matters that the water dissolves. In addition to this, wells may be considered as tending to the purification of the water that they have received from the soil, since it is there more exposed to the action of the oxygen of the air than it was while in the strata of the earth, and this contact is a cause of salubrity. But if, on principle, this influence on health is accorded to wells, we are obliged, unhappily, to own that, as we find them at the present time, in populous towns, where the soil is polluted, their real efficacy is, to say the least, extremely limited.

These are the reasons which have caused M. Chevreul to attach so great an importance to a third method of purifying towns, a method, in some sort the only one which we are now able to employ actively on the soils which are not in a condition to be incessantly washed by masses of water which act *per descensum*, or which introduce themselves as if they formed part of a great stream, on account of the permeability of the soil. This method consists in

making numerous plantations in the interiors of the towns. The great influence of trees on the health of towns is incontestable, since they only increase in size by robbing the soil of decomposable matters, proximate or ultimate causes of infection. But it is necessary to make plantations with judgment, both as to their number, their situations in the town, and the precautions to take, so that the roots can, while extending sufficiently, satisfy the wants of the development of the species planted, without being liable to reach an already infected soil, where the oxygen of the atmosphere cannot gain access.

On the manufacture of white lead and shot.

IN commencing a report on the hygienic questions connected with the effects of lead on the health of man, there is one dominant point that must never for an instant be lost sight of. It is that this metal, in all its forms, and under all conditions, is a poison; a poison the more terrible that its action is slow and insidious.

And parallel with this fact is another, the multiplicity of uses to which the various preparations of lead are applied, in the arts, manufactures, and domestic economy. Some of the compounds of lead are considered impossible to be replaced by any other material. It does not follow, however, that it is not our duty, by every means in our power, to endeavour to substitute for substances extremely dangerous, other materials which are innocuous to health, and that we should not look upon every progressive step made in this direction as a true service rendered to humanity.

While waiting a result that science will be nearly certain in process of time to accomplish, it is of importance to point out, in as clear a manner as possible, all the circumstances in which lead may exercise its deleterious action, and to pass in review the numerous occupations exposed to its influence.

It should be remarked, however, that numerous ameliorations have, of late, been introduced, and that the victims of poisoning by lead are far less numerous than they were in times but lately passed.

Influence of lead on health.

The action of the preparations of lead on the human frame is shown in a more or less rapid manner.

Sometimes a few days suffice to show the effects, but more generally it is only after two or several months' sojourn in an atmosphere vitiated by saturnine emanations that the first symptoms appear.

Indeed, for the greater part of the time, there is observed, during a period shorter or longer, certain phenomena which indicate that the lead is acting slightly on the system.

Thus, sometimes at the end of two or three weeks at most, individuals placed in conditions where the absorption of the poison is very active, become pale and thin; their flesh becomes flabby;

the skin, especially that of the face, takes on a pale yellowish tint, slightly jaundiced, in which the sclerotic membrane of the eye participates, and which coincides with a deep yellow colour of the urine.

The strength diminishes. Many persons have a sweetish or styptic taste in the mouth; their breath gives off a smell of peculiar fetor, as if there were sordes. Though the gums are generally firm, they sometimes bleed, and there is ptyalism. The edges of the gums present a bluish-grey colour, which sometimes extends to the teeth. These phenomena continue during a variable time without interfering very seriously with health, until the more severe symptoms of poisoning manifest themselves.

Most generally these commence by colic. But sometimes it is by neuralgic pains in the limbs, or even by cerebral symptoms, and especially by epileptiform convulsions, by a comatose attack, or delirium, that the invasion of the mischief is characterized. In some rare cases, amaurosis, vertigo, or continual headache present themselves. But it is matter of observation that in almost all the cases of poisoning by lead, an anesthesia, banishing all sense of pain, either in the entire body or parts of it, especially the arms and forearms, is seen.

After this the disease becomes more fully developed, and displays its well known severe symptoms.

Manufacture of shot.

In making shot for sporting purposes, from $\frac{2}{10}$ to $\frac{3}{10}$ per cent. of arsenic is added to the lead.

The addition of this small quantity of arsenic gives to the lead the property of forming perfectly round pellets. The combination, when fully melted, is poured into a sort of spoon pierced with holes, and lined with scum of lead; it filters through the scum, and falls in drops from a great height, so that they become solid in their fall.

This operation generally takes place in old ruined towers or in wells.

These establishments are classed, but only in the 3d class. They require, nevertheless, great attention, both with respect to the nature of the locality and the danger of fire.

Manufacture of white lead.

It is this branch of industry which is the most active cause of lead poisoning. It is against this branch that all the complaints, all the threats of prohibition, have been directed, which have only been staved off by introducing great improvements in the manufacture.

The number of workmen engaged in this manufacture in France has never been large. In 1836, M. Chevalier reckoned for all France only 450 men thus employed.

The principal localities where such works are established are in the department of the Seine, in the environs of Lille, and at Strasbourg.

Melting.—To each factory is annexed a melting house, in which the lead intended to be carbonated is placed.

Carbonatation.—The formation of the carbonate takes place everywhere now by the Dutch method.

A number of sheets of lead are rolled up, and exposed for two or three months to the action of fumes of vinegar, to the air, to watery vapour and carbonic acid gas, which, aided by a temperature of from 100° to 140° , oxydize the metal, and form a neutral acetate, which the progress of oxidation renders tribasic. This is afterwards decomposed by carbonic acid, forming carbonate of lead. This same action, repeated several times, produces variable quantities of white lead.

The separation of the white lead from the lead which it covers, the reducing this salt to powder, and the sifting, are the most insalubrious parts of the operations.

The workman first detaches the large scales or crusts of white lead, which are but slightly adherent to the lead not acted upon; he takes in his hands the sheets of lead covered with white lead, unrolls those that were placed in the pots, twists them about in different directions, and puts aside the detached crusts. This operation, called in France "*epluchage*," in which the workmen have their hands constantly charged with carbonate of lead, is not, however, the most insalubrious part of the fabrication, because the white lead separates in thick scales, producing but little dust.

The sheets of lead so scaled still retain in different places white lead, which adheres strongly there. The operation of removing the white lead from those parts is known by the name of "*decapage*." It was formerly performed by placing the sheets of lead on stone ends, and beating them with a piece of wood. The white lead then came off, some in scales, some in fine powder, inhaled with the atmosphere by the workmen. This operation was most injurious. The *decapage* is performed at the present time, in most of the factories, by mechanical processes, which injure the health of the artisans much less.

The white lead is then mixed with water and ground in mills, so as to form a soft paste, and made to pass under several mill-stones. This operation is perfectly inoffensive. The workmen do not touch the paste with their hands.

The soft paste is put into conical earthen pots, and exposed to the action of fire. Much of the water is thus evaporated, and the contraction of the mass of white lead separates it from the inside of the pot, so that it is easily extracted. After being entirely dried by hot air, much of the lead is then sold in that condition, viz., loaves. This does not, therefore, at all undergo the dangerous process of dry powdering.

But the greater part of the white lead in loaves undergoes another powdering, followed by sifting, before being sold for commercial purposes. This grinding is even still performed, in many establishments, by vertical stone mills, turning on horizontal stone tables, and it is afterwards sifted through a fine sieve. The grinding, dry sifting, and subsequently packing it in barrels, by the

above processes, are operations evidently highly insalubrious, on account of the powder which spreads over the workshops.

M. Lefebvre, of Lille, one of the principal manufacturers of white lead, has modified this method of working. Instead of vertical mills working exposed to the air, he employs horizontal mills of white marble, enclosed in metallic drums, perfectly airtight. The lower mill or stone is motionless, the upper mill makes 260 revolutions per minute. The lead, reduced to powder, is thrown by the centrifugal force to the circumference of the stones; from thence it passes into a strainer enclosed in a closet with double doors, and falls, in the state of powder, into a kind of waggon, capable of holding 2,500 lbs. This waggon is not withdrawn until the powder has entirely subsided.

But the most important progress of all those that have been made in the manufacture of white lead consists in the practice which is now becoming very general, of delivering it mixed with 7 or 8 per cent. of oil.

A diminution of the inconveniences of the latter operations, which are performed entirely in closed boxes, disappearance of the dangers which accompany the packing, the pounding, and of the making into paste by the journeyman painter; such are the principal results of this practice, as fortunate for health as in a commercial point of view.

It is difficult to give an accurate account of the proportion of workmen attacked. It is, however, quite certain that, thanks to the improvements introduced, there are now scarcely any attacks among the men employed in Lille. The witnesses are unanimous on this point, and M. Lefebvre says that he can now actually dispense with a medical man. It is unfortunately not the same in Paris. A great number of workmen there suffer; and, remarkable to relate, it is precisely at Clichy and Ivry, where means reputed to be prophylactic, particularly sulphur baths, sulphur lotions, and change of work, are put into force. Nothing similar is practised at Lille, and at M. Lefebvre's, whatever has been said, the men are neither regularly inspected by a surgeon, nor forced to go to the baths, or to use lotions, or particular beverages. At the very most, they are furnished with blouses for work, and with gloves, which the great majority neglect to use. The daily wages of the men are 2 francs, $1\frac{3}{4}$ francs, and $1\frac{1}{2}$ francs. One fact cannot be passed over in silence, it is the almost constantly renewing of the workmen in the factories in the environs of Paris, so that for one hundred men daily employed, there will have worked during a year some fifteen hundred, whilst in the north, for a second-rate factory, that of M. Lecroart, for example, who employs eighteen workmen, scarcely more than twice that number pass through.

Adjoined is a table giving the number of attacks and deaths from lead affections, taken from the Paris hospitals, for the last 14 years, distinguishing the men from the two factories, from Clichy, where the recent improvements have not been introduced, and from Ivry, where they have. This table comprises also painters and other professions where men have suffered from lead affections.

TABLE showing ATTACKS of LEAD DISEASES in PARIS HOSPITALS during 14 Years.

Years.	Total deaths.	Total attacks.	White Lead Workers.				Painters.	Other Professions.
			Deaths.	Total.	Clichy.	Ivry.		
1839	8	211	7	139	130	7	48	24
1840	10	248	—	152	123	28	47	49
1841	12	302	11	236	161	51	39	27
1842	22	316	18	252	169	53	43	41
1843	9	260	—	204	—	—	45	11
1844	14	325	12	231	159	62	41	53
1845	17	475	13	257	196	29	113	105
1846	13	552	9	355	—	—	133	64
1847	10	425	7	227	180	40	132	66
1848	1	172	—	88	65	22	59	25
1849	1	202	—	118	108	10	38	46
1850	1	238	1	154	134	20	49	35
1851	1	216	—	140	125	—	48	28
1852	1	217	—	—	—	—	—	—
	120	4,159	78	2,553	1,550	322	835	574

However much diminished the dangers arising from the manufacture of white lead may have become, the well-known and constant insalubrity of this industry has not ceased for one moment to be an object of solicitude to men of enlightened minds: and when the discovery of white of zinc showed the possibility of substituting this inert preparation for the very noxious one of white lead, much excitement was produced amongst those who occupy themselves with the health of workmen. His Imperial Majesty's Government could not remain a stranger to this emotion, and the question of the absolute suppression of the manufacture and use of white lead has been seriously discussed. This question was submitted to a Committee of the Academy of Sciences, composed of the following gentlemen:—

Messrs. Chevreul, Majendie, Regnault, Séguier, Bussy, Legentil, Barbier, Davenne, and A. Tardieu, Secretary.

After giving the subject much deliberation, the Committee presented to the Minister a report, ending in the following recommendations:—

1st. There are not sufficient reasons for interdicting the manufacture of white lead, the improvements introduced into this fabrication having removed from it almost completely its insalubrity and its dangers; but it is of importance that the Administration should take measures that these improvements be adopted in all the factories, and that these themselves should be an object of special surveillance.

2d. There are no sufficient reasons for interdicting the use of white lead in works or painting, because certain precautions can

place the workmen out of all danger of lead powder and dust; and also because, to a certain point, for this particular use, the substitution of white zinc for white lead is gradually taking place of its own accord; and the support of the Government, and the difference of duty in favour of zinc over lead, encourage this substitution, without violent disturbance or interference with the freedom of commerce.

3d. The interdiction of the fabrication and the use of white lead in the arts and in commerce would have, moreover, the inconvenience of exciting grave difficulties as regards the state of the finances, &c.

The report, of which these are the conclusions, was read and discussed in the presence of the Minister and the Director General, and adopted unanimously. The Minister thought it necessary, while maintaining the manufacture of white lead, to ensure to all the workmen employed the benefit of the improvements already realised, as well as of such as might hereafter be brought about.

He, therefore, confided to the same Commission the task of preparing a general regulation applicable to all manufactories of white lead, and also of issuing a code of instructions on the use of this substance.

This required a profound study of all the processes made use of in the principal factories in France and in foreign countries. This study is not yet completed, and we cannot anticipate its results; we will, therefore, limit ourselves to saying, that making the manufacture of white lead perfectly healthy requires, besides the generalised employment of the machinery and apparatus above described, the greatest possible extension of working under water, and the preparation of the white lead in the form of ground paste.

We subjoin the conclusions of the Commission of the Academy of Sciences, composed of Messrs. Rayer, Pelouze, and Combes:—

“The maladies of white-lead workers may generally be prevented by the substitution of mechanical processes for manual work in those operations where the men are obliged to touch and handle the white lead.

“By the medium of water in the separation of the scales from the sheet lead, the powdering of these scales, and the sifting which follows.

“By substituting moulding in the form of prisms or bricks for the potting of the white lead made into paste with water.

“By making into a paste with oil, in the manufactory itself, by the aid of suitable apparatus, all the lead which has to be mixed with oil before being used.

“By enclosing in isolated chambers of the work-rooms all the machinery used for pulverizing, straining, or dry packing the white lead, when these operations are indispensable.

“Lastly. These measures will be rendered complete by a very active ventilation of the work-rooms, and by hygienic precautions of a nature easy for the workmen to observe.”

*On the manufactory of white lead in Paris, conducted
by M. Besançon.*

THE large manufactory of white lead conducted by M. Besançon, in Paris, employs constantly twenty-five men, and produces annually one million kilograms of this substance.

The first process, that of melting the lead, for the purpose of running it into moulds of the form best adapted for its carbonation, does not appear to have any injurious effect upon the health of the workmen, except their occasional liability to burns. The same man has been employed in that part of the work for upwards of seven years. No emanations take place during the melting. There is always a high temperature, but by means of an inverted funnel over the stove and melting place, great part of the caloric ascends the flue without escaping into the general atmosphere of the workshop.

The lead is then exposed to the action of fumes of vinegar permeating layers of tan, and when this process is completed the white lead is beaten off from the bars of metallic lead. This process is done by hand, and is the only part of the manipulation as conducted at these works that appears to present any real danger to the workmen.

Here they are exposed considerably both to the inhalation of the white lead in powder, as well as to the continual contact of it with their hands, and other parts of the body. Every precaution, however, is taken to diminish this danger as much as possible.

No man is allowed, under any circumstances, to continue at this work for more than seven days consecutively. On quitting their work the men are obliged to wash their hands and face in water containing a solution of sulphuret of potassium, secondly in water holding clay in suspension, and thirdly in pure water. They must use these ablutions whenever they cease work, before taking a meal, or retiring for the day. These are among the regulations of the police, and are made known to the workmen by placards printed and fixed up in various parts of the factory.

The white lead in small lumps beaten off from the cast lead is then ground to an impalpable powder, under water, between horizontal stones. Not the slightest powder, vapour, or smell escapes during this process. When the white lead has been thus finely ground, as much water as possible is pressed from the paste thus produced, which is then cut into masses, placed upon plaster of Paris or some absorbent material, and exposed to a current of warm dry air until it is perfectly anhydrous. These dry masses are then placed in large receiving boxes and reduced to small pieces by receiving a few gentle taps with a hammer.

No dust escapes in this manner, and this is an improvement in this part of the process well worthy of imitation in the English manufactures.

It is then placed in mills and mixed with a certain proportion of oil *immediately*, and the grinding is performed in contact with the oil, to prevent the escape of particles of the lead. No lead whatever is sold at this factory in the state of powder. It is all sent out previously mixed with the oil.

After the drying, as the lead before admixture with the oil must be in the form of an impalpable powder, it is passed through very fine sieves. This process, which in many manufactories is still done by the workmen themselves who shake the powder through the sieves, is performed here in hermetically sealed closets or small rooms, in sieves supplied with the lead and having their shaking motions communicated to them by the steam engine that works the grinding mills.

The whole manufactory is remarkably free from smell and dust. Every room and workshop is swept twice a day, while the men are absent from work. All the men appeared in perfect health, and quite free from all the symptoms of inhalation of lead. There was no blueness of the gums or any of the signs of lead poisoning to be seen. They assured me that none of them had suffered since they had worked in M. Besançon's factory, and M. Trebuchet, the Chef du Conseil de Salubrité, at the Prefecture of Police, who accompanied me in my inspection of this and the other établissements industriels which I visited in Paris and its suburbs, stated that he had never received any complaints from the workmen of this factory since it had been carried on with its present improvements. Nevertheless, 5,000 kilograms of white lead are daily manufactured and ground therein.

The reason that painters and others who use white lead as paint, mixed with oil, suffer so severely from painters' colic, is, that they are not careful to remove from their hands and bodies the white paint which adheres to the skin, and which soon becomes absorbed.

Frequently they eat with their hands unwashed, and thus also convey directly to the stomach this mineral poison.

This manufactory is all that such an establishment can be, and is worthy of being made a model except in the following respect:—

The process of removing the carbonate of lead from the plates of metallic lead, now done by hand and sticks, could very easily be accomplished by some very simple machinery, out of contact with the atmosphere breathed by the workmen, or under water.

On the use of lead for water pipes, and for other purposes of domestic economy.

It has been said by a very celebrated physician—Rasori—
 “ The most common and the most remarkable cases of accidents
 “ caused by lead are generally due to the substances of which we
 “ make the most frequent use, and which only contain very
 “ minute quantities of this metal.” He might have added, that
 these substances having no disagreeable taste, excite no suspicion;
 so that one may be attacked with lead disease, and attribute the
 illness to any but the real cause. Many instances could be
 brought forward which show that persons attacked in 1841, 1851,
 and 1852 with painters' colic, were treated for other complaints,

and that it was not till later that positive data were obtained of the causes which gave the disease. It is probable that a great number of such cases occur without their real nature ever being discovered.

On the action of water on lead.

Does water in contact with lead dissolve this metal, and can it become injurious to health?

Authors are not all agreed on the action of water on lead; indeed, there are authors who say that this liquid has no action on the metal; others have emitted an opposite opinion; others again assert that while certain waters have no action on lead, others have a marked effect on this metal. Louis, in a memoir that he has published on this subject, has made it known that water is capable of holding in solution lead in the state of acid carbonate, and that that which is not acidulated, and which is not in contact with the atmosphere, is in no manner altered in leaden vases. In support of this opinion, water which has passed through leaden pipes for a long series of years, without giving rise to any accident, has been instanced. M. Chevallier does not partake of this opinion, but believes that there are waters which, in traversing pipes, dissolve small quantities of lead, the dangers of which are not appreciated, because their evil effects have not been immediate.

Mérat and Barruel have proved that when water is kept in reservoirs of lead in contact with air, the carbonic acid combines with the carbonate of lead, forms an acid carbonate, which dissolves in the water. They made the following decisive experiment at the Faculty of Medicine in Paris:—Six double pailfuls of water were left for two months in a copper lined with lead; after the lapse of that time, analysis showed that the water contained 64 grammes (990 grains) of carbonate of lead.

Trouchin showed that painters' colic was very common at Amsterdam, and attributed the fact to the waters of that town being received on leaden platforms, and then running into cisterns, being used for drinking.

Wanstroostwyh remarked that at Haarlem the water caused the same accidents, due to the same causes.

M. Chevallier has examined water kept in leaden reservoirs, which at the floating line showed a greyish white discoloration, indicating the alteration of the metal; he showed that at the lower part of the cistern there was found a white precipitate of carbonate of lead; but, among the waters thus examined, there were some which showed, by tests, the presence of lead in solution, whilst others showed no indication of the presence of this metal.

In support of these experiments Dr. Christison, of Edinburgh, has established:—

1st. That there is danger in using leaden pipes for conducting water a considerable distance, without previously submitting the water to analysis.

2d. That the purest waters dissolve most lead.

3d. That the water which tarnishes shining lead after a contact of several hours, ought not to be conducted in pipes of this metal, until after certain precautions have been taken; that it is probable, *although this has not been proved*, that if the lead preserves its brilliancy after twenty-four hours of contact, leaden pipes may be used to conduct water which has had no reaction on the metal, and this without danger of accidents.

4th. That water which contains $\frac{1}{8000}$ of its weight of salts in solution cannot traverse pipes of lead without particular precautions.

5th. That this proportion of salts will be even insufficient to prevent alteration of the metal, unless carbonates and sulphates form the greater proportion of them.

6th. That the proportion of $\frac{1}{4000}$ and more even will be insufficient, if these salts are chlorides.

7th. That it is desirable, in all cases, the water offering even to appearance all the guarantees of purity, to make a chemical analysis thereof, after having left it some days in contact with the pipes.

8th. That when the water is of a nature to change the pipes and to attack this metal, it is proper to leave the pipes filled with water for a period of three or four months, mixing with this water a solution of phosphate of soda, containing $\frac{2}{1000}$ of this salt.

9th. That sulphate of lime in the proportion of $\frac{1}{1000}$ may be made use of in the same manner; in this case there takes place a precipitation on the pipes of a salt which protects them from further action.

The dangers which result from the use of water which has sojourned or run in leaden pipes, are clearly pointed out in the paper published by Dr. Guéneau de Mussy, called "*Historique de plusieurs cas d'empoisonnement qui ont eu lieu à Claremont par le plomb.*"

M. Guéneau de Mussy states, that being sent for to Claremont at the commencement of October 1848, he had to see several illustrious persons attacked with colic from an unknown cause; having studied the symptoms presented, he came to the conclusion that they were the result of poisoning by lead.

Examination of the gums confirmed this diagnosis; the analysis of the water commonly used by the patients, made by Professor Hoffman, showed that it contained a considerable amount of lead. The water from the leaden pipes was then discontinued, and various medicines ordered. Purgatives, with belladonna and opium, were prescribed, but unsuccessfully, in those cases where the poisoning had been of slow access, and the symptoms chronic. The results following the administration of resinous and saline purgatives, of castor oil, of calomel, of Croton oil, of sulphate of magnesia, were not more satisfactory. M. Guéneau then abandoned these medicines, to have recourse to sedatives, opium, belladonna, ice, weak infusion of rhubarb, which succeeded better in calming the nervous system and removing the constipation.

In the case of those patients who were experiencing the early symptoms of the disease, the disturbing action of energetic purgatives stopped the spasmodic accidents, which quickly disappeared.

The three patients who had more particularly attracted the attention of M. Guéneau by the severity of their symptoms, had been relieved by antispasmodics; but success was not complete, and these patients, whose system was still saturated with the poison, showed symptoms of cachexia. Dr. Guéneau then determined to make use of a chemical treatment; he prescribed a syrup of hydrated sulphuret of iron and sulphurous baths; the patients took a sulphurous bath every other day, and every alternate day a soap bath.

With two of the patients who were thus treated, chemical reaction showed itself in a most decided manner; in fact, the nails of the hands and feet contracted a black colour, and stains of the same colour showed themselves in different parts of the body. These last stains were removed by baths and friction with soap, but the discoloration of the nails did not take place by the same means.

Dr. Guéneau in this manner succeeded in curing his patients; and he says, that while some physicians and chemists have looked upon sulphur as the only remedy for poisoning by lead, others have considered it to be quite useless; that he is of the opinion of the former, since the success that he obtained by sulphur much surpassed his expectations.

Dr. Guéneau states that the lead did not act with the same intensity or the same rapidity on all the patients at Claremont. This fact explains itself, and one constantly sees in factories, patients who are not affected by the white lead, whilst others are attacked with frightful rapidity.

Dr. Guéneau then proceeds to give statistical details of much interest; out of 38 persons inhabiting Claremont, 13 were attacked with lead colic, 11 being men and 2 women.

The stream which supplies the palace at Claremont with water is derived from a spring which rises in a bed of sand about two miles from the palace; this stream had been selected from among several others on account of its great purity, and it had been brought, about five years before, to Claremont through leaden pipes. From what has been said above, it will be seen that the purity of the water had been the cause of the danger.

M. Guéneau shows also, that in various parts of England, accidents, due to the action of water on lead, had been previously observed, especially at Weybridge, in Surrey, at Windsor, &c.; and he asks, how is it that the water used at the Palace of Claremont had been used for so long a time without any accidents having been observed before? To this he replies:—The leaden pipes conducted the water into a large natural cistern, situated at a short distance from the spring; when the persons who have been the subjects of the numerous observations which precede, came to occupy the palace, they desired that the natural cistern

should be preserved from the animal and vegetable detritus which fell into it. For this purpose, a cylinder of iron, two yards in diameter, and six and a half in height, was constructed; it was sunk in the soil to a depth of five yards; the water ran into the cylinder, and a leaden pipe was fitted into it with a sort of mouth in the shape of a funnel, which jutted out some inches over the wall of the cylinder. This cylinder was closed at the top with an iron cover pierced with holes, which permitted the atmosphere to exert its pressure on the surface of water.

M. Guéneau is of opinion that all the mischief arose from thus altering the apparatus. According to him, the fact is certain; but, he says, at the same time, that he has only suspicions concerning the chemical reaction which caused the alteration of this water.

M. le Dr. Guérard, however, in a work full of interesting observations, has given an explanation of these facts, which deserve consideration. Nothing is easier, he says, than to explain what took place in this affair.

It is known, in accordance with the observations of M. Pouillet, that lead is positive with regard to iron, and especially cast iron. The substitution of the cylinder of iron for a leaden cistern, would have for result the effect of favouring the oxidation of the lead, which once transformed into the hydrated oxide, would be changed into carbonate, and dissolved in the excess of carbonic acid contained in the water. As the proportion of the poisonous agent was but small, the effects to which it gave rise only began to show themselves after a prolonged use of the poisoned water.

We deduce from this interesting fact a precept which we must not lose sight of; it is, that in reservoirs intended to contain water for household use, we must avoid establishing even an intermediate contact between lead and another metal, *and especially iron*.

We must not pass over in silence an observation which is interesting, in the highest degree, to the health of sailors, and to which recent facts have given great importance. Water distilled at sea by means of the "distilling kitchens," furnished with worms of lead, becomes charged with this metal, and it is to the employment of this water that have been attributed, in some cases, the attacks of colic experienced by a great number of the crews. Leaden worms should not be used in this apparatus, they should be iron.

We are perfectly convinced, says M. Chevallier, that the employment of lead to preserve or conduct water intended for alimentary purposes, may be followed by dangers more or less serious, and that it is indispensable to proscribe this metal for such purposes; by so doing, all danger will be avoided, and accidents prevented.

On the employment of the vases and utensils for the kitchen.

As to utensils and vases for kitchen use, for the table, or for the preservation of condiments, it is difficult to calculate what might be the effect of the lead entering into the composition of objects so universally employed. When it is considered that all the

common pottery is covered with a leaden glaze, capable of being acted on by the greater part of the condiments, greasy and acid materials, one is invincibly led to ask the question whether the incessant mixture of these small quantities of poisonous substances does not, in the long run, exercise an influence more or less deep on public health. This idea, that we should not, perhaps, have advanced without hesitation, we have frequently heard emitted and sustained by one of the most eminent members of the Council of Public Health; and we do not hesitate to say that it is worthy of the consideration and meditation of all hygienists. In some cases, direct observation shows how well this fear is founded. M. Chevallier reports the example of a farmer of the Gironde, who was attacked with painters' colic, brought on by gherkins which had been kept in a glazed earthen vase. The glaze was everywhere decomposed by the acetic acid; the vinegar in which the gherkins macerated was muddy, thick, and milky; it contained acetate, carbonate, sulphate, and chloride of lead.

Sometimes leaden salt cellars are employed. This is a dangerous custom.

The use of apparatus for making gaseous liquids, if containing leaden or pewter pipes that come into contact with the liquid, is to be avoided.

Sheet lead should not be employed for enveloping certain alimentary substances, especially preserves, or for tobacco.

Action of beer on leaden pipes.

Several cases of poisoning by lead having occurred in Lille and its vicinity, and these being traced to beershops, the subject was brought under the notice of the central Council of Salubrity of the Département du Nord, by M. le Dr. Gosselet; the following were the conclusions come to, which, with the report itself, received the sanction of the consulting committee, and subsequently of the superior authority.

1st. Beer, after remaining twelve hours in a leaden pipe, which has served to convey the liquid, carries with it lead both in a soluble and in an insoluble state.

2d. That this action takes place daily in the conducting pipes; that it is augmented by the acidity of the beer; that the longer the beer is kept in the tubes the greater is the action; that this action is exerted particularly during the night, so that then the beer may contain, on the average, half a milligramme of lead per quart.

However weak this amount may appear, it is very clear that it may prove noxious, as it is impossible to measure the toleration of each idiosyncrasy, and it may happen, for instance, that this beer may be supplied every morning to one or two individuals who come to drink it before their breakfast.

It will, therefore, be prudent to prohibit absolutely the use of such pipes; and also to recommend practicable and inoffensive substitutes for them.

These substitutes must communicate neither odour nor taste to

the beer, and they must possess a certain flexibility to adapt themselves to the various positions of the barrels in the cellar.

M. Chevallier, who has consecrated great part of his life to the pursuit of this dangerous poison (lead), through so many of the common every-day substances, into whose composition it insinuates itself, guided by his great interest in the well-being of his fellow-creatures, has also experimented on the action of wine and cider on vessels of lead. He has proved that after forty minutes of contact, these liquids show the presence of lead, and that while cider attacks the metal with the greatest energy, all three, cider, beer, and wine, present, after a lapse of twenty-four hours, when treated with sulphuretted hydrogen, a considerable quantity of lead.

In many parts of France, wine and cider have been clarified with white lead and carbonate of potass, and a large number of attacks of painters' colic, and several deaths have resulted from this most reprehensible practice.

On the regulations in force in France regarding brickmaking.

BRICKS, which are nothing but clayey earth baked, are made sometimes in ovens heated with wood, sometimes in the open air.

The first method causes abundant development of smoke at the commencement of the firing, and the establishments of this sort are, therefore, arranged in the second class of insalubrious establishments.

The second process is the most common in the north. The bricks are burnt in the open air, in heaps of several hundreds of thousands. Coals are there made use of, and, by preference, those which give the least smoke.

The greatest inconvenience of these heaps of bricks is, that they give off great heat by radiation, and that they throw in great abundance into the atmosphere air heated strongly and charged with the products of the combustion of coal. The crops and the leaves of the trees are sometimes scorched by it at a distance of 50 or 60 metres. These establishments, under the title of briqueteries, making up only one single furnace in the open air, are classed in the third category. No year passes that the Boards of Public Health and Salubrity of the Department du Nord are not consulted on 10, 15, or 20 demands for authority to establish works of this nature.

The constant jurisprudence of these Councils consists in imposing the following conditions:—

1st. Not to burn the bricks at a less distance than 50 metres from a public way, in conformity with a Police Law of the 22d June 1812.

2d. To surround the furnaces during the burning with canvas or mattresses stuffed with straw, intended to protect the neighbouring properties from the inconveniences of the smoke.

In certain cases permission to burn bricks in the open air has been refused, on account of the neighbourhood of a nursery-ground; and a close furnace has been exacted.

It is always arranged that in all cases of injury accruing from the smoke, the injured parties have a claim for redress. This is why many brickmakers subscribe to an engagement not to burn bricks until after harvest.

The Council of Salubrity of the Department of the Bouches du Rhone have always ordered that brick-burning furnaces shall only be lighted at the commencement of night. This plan greatly diminishes the inconveniences resulting from the smoke.

On the insalubrity caused by the process of gilding metals by means of mercury.

THE art of the gilder by mercury has many kinds of inconveniences, which ensue from the operations necessitated.

These operations consist in the preparation of the gold amalgam, the "dérochage," the gilding, the volatilisation of the amalgam, the burnishing, the deadening, the treatment of the waste metal, and the cleaning of the flues.

These various operations are insalubrious from the following causes:—

- 1st. The volatilisation of the mercury.
- 2d. The disengagement of hyponitric acid.
- 3d. The contact of nitric, sulphuric, and hydrocyanic acids with the workmen's hands.
- 4th. The contact of the mercury and the acid nitrate of mercury under the same circumstances.
- 5th. The possible respiration of mercurial vapours, of acid fumes, and of soot or small particles of coal containing compounds of mercury.
- 6th. All these mercurial or acid fumes may spread into neighbouring habitations.
- 7th. The escape of the waters over the public ways may occasion the destruction of the paving or draining materials.

The following are the hygienic prescriptions of the Council of Salubrity of Paris, which indeed are due for the most part to the inexhaustible genius of D'Arcet.

A furnace constructed on the system of this chemist, that is to say, provided with particular melting places for each of the operations where vapours are disengaged, prevents all the dangers arising from the volatilisation; great care must also be taken in making openings as small as the execution of the operations of the workman will permit, and to supply the furnace room with the largest possible amount of air that the furnace requires.

D'Arcet has directed attention to the *descending* currents that may take place in a chimney, and to the causes that may give rise to these. One can easily conceive the dangers which may result from such currents, established in the chimnies of gilders, when

these are lined with a mercurial soot, or still filled with acid or mercurial fumes, after operations but recently terminated.

The workmen are recommended, with the view of preventing the contact of the mercury and the amalgam of gold and of the acids with their hands, to wear while at work gloves of bladder, of varnished silk or leather.

Colonel Paulin has proposed the use of particular gloves for the workmen who use the scratch-brush. The workmen are also strongly advised, with the same view, to wash their hands frequently in soap and water, in order to saturate the acids with which the hands are frequently impregnated.

There are other precautions to prescribe in respect to sweeping the chimnies. The sweeper should be clothed in such a manner that every part of his body, the face excepted, should be out of contact with the dust, and a moist sponge should be placed before the nose and mouth, so that during the act of respiration no particles of soot be introduced into the mouth or lungs. Before ascending the chimney, also, a considerable quantity of steam should be sent up the chimney, the object of this precaution being to prevent the formation of dust, and to condense the existing vapours.

The following are the precautions recommended by the Council of Salubrity to preserve the neighbours from the injurious conditions in which they might otherwise be placed.

The chimney of the gilder is, in fact, the channel of escape for all the insalubrious emanations.

These emanations are carried to a distance, so much the greater as there exists a stronger draft and more fire in the furnace; their quantity is in proportion to the importance of the establishment. It follows, therefore, as a general rule, that a gilder by mercury is an unwholesome and sometimes even a dangerous neighbour. From thence results the necessity of an extreme elevation of his chimnies, whatever may be the combustible employed, and this elevation should be larger as the quarter is more populous. Ordinarily the Council of Health demands two or three metres above the roofs of any of the neighbouring habitations within a radius of 25 metres.

The escape of the washing waters through the public ways is a source of mischief to the soil by the quantity of acids they contain. The Council of Health prescribes the saturation of these acid waters with chalk before they leave the establishment.

The establishments of metal gilders are placed in the third class of insalubrious establishments.

On the Regulations contained in the Royal Ordonnance of 27th January 1846, regulating the manufacture of gas.

THE manufacture of gas, which has now assumed not only in large towns but even in small cities, an extraordinary develop-

ment, demands on the part of the administration strict surveillance and minute regulations.

The immense furnaces indispensable for the manufacture of a product essentially inflammable itself, necessarily incur danger of fire, at the same time that they produce considerable smoke and odorous gas, very noxious to the neighbours.

Therefore the administration has imposed special conditions on the factories where gas is made, on the works for condensing and purifying, and on the gasometers and portable vessels into which the gas is compressed.

The danger of the gasometer bursting has been much exaggerated. In order that the gas of a gasometer should explode, it must contain at least seven times its volume of atmospheric air, which, according to Messrs. Monfalcon and de Polinière, is impossible under any circumstances. It is known that the quantity of oxygen necessary to make carburetted hydrogen explode, depends upon the proportion of the elements of this gas. To be completely burnt, the bicarburet of hydrogen requires three times its volume of oxygen; but oxygen only enters for one-fifth into the composition of atmospheric air.

The circumstances are changed when the gas, escaping by some fissure or through some badly closed cock, accumulates in a well closed apartment; the mixture which results from its union with the atmospheric air may cause an explosion on contact with a light, and this it is which so often takes place.

The necessity results from such accidents to find a speedy remedy for escapes of gas, and to close the cocks perfectly.

When gas escaped from a fissure or an open tap accumulates in a closed room, much more severe accidents may result. Persons asleep have been asphyxiated and have perished.

The more sulphuretted hydrogen the gas contains, the more deleterious is its action on the respiratory organs.

One of the greatest embarrassments which have weighed upon this industry (gas making,) is the residues furnished by the products of condensation and purifying, of which it has been for a long time very difficult to find the means of riddance, or for employing usefully.

The tar, a very considerable product of the distillation of coal, has a very disagreeable odour, which communicates itself to the washing waters and to the water of the gasometer, where it unites with another product of the distillation, the sulphuretted hydrogen. These waters, which they did not know what to do with in London, were formerly conducted to the Thames, where during several years they infected the river for a considerable distance and destroyed the fish.

This took place in Paris, thirty years ago; an enormous basin of the gas factory of the Luxembourg having burst, all the materials contained in this basin found their way into the river, not without having infected several quarters of the town, and caused a vast number of fish to perish.

These products are now utilised.

ROYAL ORDONNANCE concerning GAS WORK 27th January,
1846.

1st. The works where hydrogen gas is produced, and the gasometers belonging to them, remain arranged in the second class of establishments dangerous, unwholesome or inconvenient, except in two following cases.

2d. Are ranged in the third class those small apparatuses for making gas, that are only able to produce, at most, 10 cubic metres in 12 hours.

3d. Are equally ranged in the third class, the gasometers not belonging to apparatus whose capacity exceeds 10 cubic metres. Those of a less capacity may be established after declaration to the municipal authority.

4th. The workshops for the distillation, all the buildings belonging thereto, and the magazines for coals belonging to still-rooms, even when they are not attached to these rooms, shall be built and covered with incombustible materials.

5th. There shall be established on the highest part of the roof of the workshops, for the exit of the vapours, one or several openings surmounted with pipes or chimneys, the height and diameter of which shall be fixed by the act of authorization.

6th. No animal matter shall be employed for the manufacture of gas.

7th. The coke shall be extinguished on its being withdrawn from the retorts.

8th. The condensing apparatus shall be constructed in the open air, or in buildings ventilated at the upper part, unless the condensation be carried on in pipes sunk in the soil.

9th. The apparatus for purifying must be erected in buildings ventilated by a special chimney, established at the upper part of the roof, the height and diameter of which are to be determined by the act of authorization.

The gas shall never pass from the retorts into the gasometer without previous purification.

10th. All other mode of lighting other than that of safety lamps is formally interdicted in the condensing and purifying places, as well as in the interior and environs of the buildings enclosing gasometers.

11th. The ammoniacal waters and the tar produced by the distillation that are not immediately removed, shall be deposited in pits hermetically closed and water-tight, the capacity of which which must not exceed 4 metres cube.

These receptacles must be constructed of stone or bricks and hydraulic mortar, and covered with cement equally hydraulic; they must be placed under covered buildings.

12th. The tar, the ammoniacal waters, and the milk of lime, as well as the solid lime from the purifying apparatus, shall be immediately removed in vases or barrels hermetically closed.

13th. The aqueous residue must not be evaporated, nor the tar burnt in the cinders or in the furnaces, if any smoke or odour shall result from so doing.

14th. The number and size of the gasometer of each manufactory shall be such as, in case of accident happening to one of them, the others may suffice for the requirements of the supply.

Each factory shall have at least two gasometers.

15th. The basins into which the gasometers plunge shall be completely air-tight; they shall be constructed of stone or bricks and hydraulic mortar, or of wood; if the basins are of wood, they shall be placed in a receptacle of masonry.

If the walls rise above the surface of the ground, they must have a thickness equal to half their height.

The basins at the level of the ground shall be surrounded by a balustrade.

16th. The bell of each gasometer shall be supported by fixed chains, so as never to swerve from its vertical position.

It shall, moreover, be so placed that the elastic force of the gas in the interior of the gasometer shall be greater than the pressure of the atmosphere. The internal pressure of the gas shall be indicated by a pressure gage.

17th. The gasometers of a capacity greater than 10 metres cube shall be entirely isolated, not only from the buildings of the works, but also from the neighbouring habitations, and shall be protected by lightning conductors, the stems of which shall have an elevation equal to not less than half the diameter of the gasometer.

18th. Every building containing a gasometer, of whatever size, shall be ventilated by means of openings made in its upper part, so as to avoid an accumulation of gas in case of escape.

There shall be made, moreover, in its sides several openings, which should be protected by open blinds.

19th. A safety tube, intended for conveying the gas above the roof, shall be adapted to every gasometer established in a building.

If the gasometer is in the open air, the tube may be replaced by four openings of 1 or 2 centimetres in diameter, placed at 8 or 10 centimetres from its lower border, and at equal distances from each other.

20th. Only gasometers not exceeding in size 10 metres cube at most, may be placed in cellars, such cellars to be only used for the gasometers. They shall be properly ventilated by means of two openings, placed one near the floor of the cellar, the other in the highest part of the arch. This latter opening shall be surmounted by a tube for escape, more elevated than the roof of the house.

21st. The first filling of a gasometer can only take place after a verification of its construction, and in presence of an agent delegated by the municipal authority.

22d. The portable recipients of condensed gas shall be made of copper or sheet iron; they shall be proved by a pressure double that which they will be subjected to in daily use, and which shall be determined by the act of authorization.

23d. The gas furnished to consumers shall be completely purified. The purity shall be certified by means prescribed by the administration.

24th. The works and apparatus above-mentioned may, besides,

be subjected to measures of precaution which may be recognized as useful in the interest of safety or of public health.

25th. The Royal Ordonnances of 1824 and 1838 concerning gas establishments are repealed.

On a new method of purifying gas, to which was awarded the Montyon Prize by the Academy of Sciences of Paris in 1850.

(Extracted from the "Comptes Rendus" of the Imperial Academy of Sciences of France.)

SINCE the year 1841 M. Dumas has given to the Academy of Sciences a favourable account of the process invented by M. Mallet; since that period the committees for adjudging the Montyon prizes have frequently been occupied with examining this process.

The different reports all gave similar testimony; but it was judged expedient to wait until the realization of the principal advantages of this new application had acquired, by being tried in several gas manufactories, such a degree of certitude as rendered sure the service performed.

The Commission thinks that this time is now arrived; for a great number of manufactories have now adopted this method of purification. It is now established in the manufactories of gas at Roubaix, Turcoing, St. Quentin, St. Denis, and Douai.

In Belgium the same apparatus acts with success in three factories—Brussels, Bruges, and Courtrai.

The process of M. Mallet consists in the employment of metallic solutions, particularly of chloride of manganese—the residue of the preparation of chlorine. This solution, saturated with some of the ammoniacal liquid from the gas works, is placed in the apparatus or purifiers disposed in three stages in such a manner that the solution passes from one into the other, whilst the gas passes through the liquid in the opposite direction.

This sort of methodical washing arrests in its passage the carbonic acid, the sulphuretted hydrogen, and the ammonia; also, the hydrochlorate of ammonia in solution. Mechanical agitators keep the precipitate in suspension in the three vases; it is from the last of these vases that the thick solution charged with the products of the purification is withdrawn. This liquid is allowed to deposit in proper recipients, the clear liquid which contains the hydrochlorate is decanted off, and the sal ammoniac obtained in the solid state by evaporation and crystallisation.

As to the gas which has undergone this first purification, it still contains a little sulphuretted hydrogen; this is very easily got rid of by passing it through pulverulent hydrate of lime, in the usual purifiers.

The process of M. Mallet, in eliminating the sulphuretted hydrogen, disposes of one of the principal causes of the infectious odour of gas, and prevents the formation of the sulphurous acid gas;

it therefore renders the air breathed more salubrious, and diminishes or destroys the inconveniences of the mixtures of sulphuretted hydrogen or sulphurous acid gas which darkened silver plate and paintings with white lead, or oxydised objects made of iron, steel, and copper.

The purification of gas by this process allows the collection of the salts of ammonia which were lost formerly. Every ton (1000 kilogrammes) of coals distilled furnishes at least 6 kilogrammes of hydrochlorate of ammonia; the gas works of Roubaix and Turcoing, St. Quentin, St. Denis, and Douai collect annually 66,000 kilogrammes of this substance; and proportional quantities are collected in Belgium.

The Commission, considering that M. Mallet has actually realized an application useful for salubrity and industry, has judged him worthy of receiving a reward of 500 francs on the Montyon foundation.

On a new method of purifying gas, to which was awarded the Montyon Prize by the Academy of Sciences of Paris, in the Year 1850.

(Extracted from the "Comptes Rendus" of the Imperial Academy of Sciences of France.)

AFTER numerous trials, M. de Cavaillon has determined the conditions favourable to the *economical action* of sulphate of lime on the carbonate of ammonia contained in coal gas. He has even contrived to unite those conditions by means so simple and, nevertheless, so efficient, that from that time he has been able to carry out the purifying process without requiring any change in the apparatus used in the manufactories of lighting gas, without even increasing sensibly the pressure on the tubes, joints, and distilling vases.

These remarkable dispositions have permitted him to introduce without difficulty his means of purification in the large gas works of Paris and the suburbs. He procures the chemical agent that he employs at but slight cost, by collecting in towns the old plaster work of pulled down walls and houses that is thrown away as useless; then with the help of a grooved mill he reduces it to powder, which, after being properly moistened, he transforms into sulphate of lime by treating it with dilute sulphuric acid. This material is rendered more permeable to the gas by adding to it broken debris of coke.

The sulphate of lime, thus prepared, is placed on the screens or strainers of wood or metal of the ordinary purifiers. The gas, in passing over this matter, abandons the carbonate of ammonia, which, in decomposing the sulphate of lime, causes a double transformation, producing carbonate of lime and sulphate of ammonia.

On leaving this apparatus, the gas passes into the usual purifiers of hydrate of lime, when the hydrosulphuric acid (sulphu-

retted hydrogen) is much more easily fixed than it could be when the carbonate of ammonia accompanied the gases.

The gas works of the Faubourg Poissonière and of Vaugirard have adopted the process of M. de Cavaillon. The skilful engineer of the Compagnie Française, M. Meymel, declares that the purification, almost perfect by this process, leaves nothing to desire; that the pressure on the retorts is not augmented; in a word, that no inconvenience whatever results from the process of M. de Cavaillon.

We have ourselves proved the exactness of these assertions in examining the system of purification at the gas works. It has been easy to make sure, also, that M. de Cavaillon extracts by means of simple cold lixiviation the sulphate of ammonia dissolved, and that evaporation permits this salt to crystallise. This process is also employed for purification in the great works of Messrs. Dubochet, Pawels, and Co., Barrière of Fontainebleau.

The quantity of sulphate of ammonia that M. de Cavaillon obtains from the three establishments exceeds 200,000 kilograms.

The ingenious processes, simple and efficacious, by the aid of which the author has realised the *economical application* of sulphate of lime to the purification of gas for lighting, are worthy of the attention of the Academy; and the Commission is of opinion that M. de Cavaillon well deserves to receive a recompense of five hundred francs on the Montyon foundation for making more healthy insalubrious arts.

On the measures ordered by the Council of Salubrity of Paris, to be taken by metal gilders by the moist process, to preserve the public health.

THE following are the measures of security ordered by the Council of Salubrity to be taken by metal gilders by the steeping method:—

1st. To restrict as much as possible the opening of every furnace, without impeding the work.

2d. To raise the chimney at least two metres above the roofs of any of the neighbouring houses.

3d. To establish a good draft furnace in each forge.

4th. Not to carry on the operations without there being a strong draft to the furnace.

5th. To keep constantly at the disposal of the workmen a bottle of ammonia, so that they can inhale the gas in case of any accidents caused by the nitrous vapours.

6th. To keep in the workrooms a certain amount of chalk, so as to saturate immediately the acid waters which might escape over the soil, &c.

On the alterations produced on the hands of burnishers of brass.

THE burnisher holds himself by the right hand which is open. The left hand serves to fix the work, which, placed between the thumb and index finger, is strongly bent against the table.

The palmar surface of the right hand becomes callous, horny, and darkened, except at the bendings of the joints. The smallest phalanx of the little finger constantly remains in a state of flexion.

On the left hand, the skin covering the dorsal surface and the radial border of the index finger, and especially the head of the second metacarpal bone, is very hard and callous. The extremity of the palmar surface of the thumb is in the same state.

On the precautions and police regulations to be observed by percussion cap and firework makers.

FULMINATING powder is composed of fulminate of mercury and nitre, mixed together by rubbing. It is indispensable for this operation to take precautions not less minute than those for making chemical matches. The moist paste resulting from the rubbing must be carried without delay to the drying house, where it is divided, and placed upon stages.

When the fulminating powder has been sufficiently re-dried, it is granulated upon a hair sieve placed on a wooden table, pressing it lightly with the hand. This operation is not less perilous than the drying, and demands as many precautions. Rubbing it too hard, more especially if there happen to be in the mass parts too dried, would cause an explosion, and M. Gaultier de Claubry states that an accident, which caused the destruction of a factory and the deaths of two operatives, was produced by that cause.

In spite of every care, as the mass to be granulated easily arrives at a state of desiccation that renders it dangerous, it is highly important only to place on the sieve a very inconsiderable quantity of powder, and to pass the sieve itself through water after each operation, and also *before* the granulation, when a certain time has elapsed between the two operations. M. Gaultier de Claubry advises that the lower border of the sieve should be covered with a plate of lead, in order to avoid detonations that would be liable to be produced if the strainer happened to fall out of the hands of the operator, and fell on the granulated material.

The granulation takes place on a wooden table; however, M. Gaultier de Claubry is of opinion that it is better to cover this table with black varnished leather or linen, well stretched, which allows the smallest particles of powder to be more easily seen, and to be removed with a damp sponge. The operation will be rendered still less dangerous by underlaying the black cloth cover with two or three layers of thick flannel or green baize. The granulated powder, mixed with priming powder, is poured into a

box of tin plate lined with tin foil. To dry the granulated powder, it is placed on sheets of grey paper in deal boxes, and these are carried to the drying-room.

When the powder is sufficiently dry, it is brought back to the granulating room, where it is poured upon a hair sieve, so as to separate the priming powder from it.

When this separation is completed, the powder is introduced by means of a pasteboard funnel into bottles, which ought not to contain more than 5 kilograms (11 lbs.)

These bottles should be surrounded with reed and covered with a skin.

When it is desired to use the powder to charge the percussion caps, it must first be placed in smaller bottles. It is poured, by means of a pasteboard funnel, into small bottles, made of varnished leather. These are then carried into the charging-room in a box lined with leather, and placed beside each woman, who uses them as her work demands.

The powder, perfectly dry, is brought from the powder-room into the charging-room, where the priming caps are made.

They begin by transferring the powder from the large to the small leathern bottles, and it is of the highest importance never to do this in the powder-room, but only in the open air, the door of the powder-room being shut. The powder is poured into the leathern bottles, which should never contain more than the quantity of powder necessary for a portion of a day's work. This transference ought to be performed on a wooden table, covered with a black glazed cloth well stretched, itself placed on two or three thicknesses of woollen material.

The *caps* are of thin copper, made hollow by machinery. They are delivered to the workwomen, who arrange and dispose them in an instrument called a *hand*, which serves to charge them with fulminating powder.

When the *hand*, which contains 100 caps, has been properly charged, it is passed to a workman, who places it under a press.

It is easy to understand that this latter operation is one of those which gives rise to the greater number of the accidents, or, at any rate, to the most frequent detonations, at the moment when the press is at work.

Numerous accidents have taught us how important it is that the press under which the *hands* charged are passed, should be disposed in such a manner that the workman should not be in front of it when he makes the lever act, in order that if an explosion does take place, he may, at any rate, avoid the shock of the projected hand.

The charging terminated, the caps are placed in boxes of pasteboard, of 250 and 500, and these boxes are packed 20 or 40 together. These packets should then be arranged with care in solid cases containing 100 or 200 packets, the interior of the case being lined with a square skin of larger dimensions than the case itself, so that it may envelop the entire contents.

This precaution is to diminish, as much as possible, all chances

of accidents which might take place during the transport of the caps from the manufactory to the magazine.

Such are the dangers that the fabrication of fulminating powder and percussion caps gives rise to, and such are the best means for preventing them. They consist, in the first place, in a good arrangement of the workrooms, which should be completely isolated, constructed of very slight materials, such as boards and canvas, so as to avoid, in case of explosion, the projection of heavy masses; and, lastly, that the rooms should be heated by the circulation of hot-water instead of by stoves.

It is right that the room where the fulminate of mercury is made, should be separated from all the other workshops; but the powder should not be carried after its desiccation any great distance, at any rate, without taking very great precautions.

In the last operation, namely, that of charging the caps, it is very important that the women who fill the *hands* should be protected by a buckler of sheet iron against the explosions. It is by such precautions as are above described, and by ingenious modifications introduced into the mechanical part of the different operations, that the inconveniences of one of the most dangerous employments which exist can be diminished.

The following are the measures of salubrity prescribed by the Council of the Seine.

ORDONNANCE for the MANUFACTURE of FULMINATING POWDER and the CHARGING of PERCUSSION CAPS.

1st. Every factory for the fabrication of fulminating powders and percussion caps shall be completely isolated from every dwelling-house, and be distant from roads and public paths; it shall be surrounded on all sides by walls.

2d. The room where the fulminate of mercury is made, shall be distant from all the other workrooms, and particularly from the powder depôt and the stores of alcohol necessary for the works.

3d. The other workrooms shall be isolated from each other, and constructed in lath and plaster without rubble; the ground shall be covered with sheet-lead.

4th. No fire shall be made in the workrooms, and no work shall be carried on by artificial light.

5th. The walls of the drying-house shall be furnished with shelves of deal, the highest of which shall receive nothing; these shelves shall be fastened at such a height that the objects placed on them can be reached without being obliged to mount either on a chair or bench.

6th. No sieve, the strainer of which is made with metallic wires, can be employed, and the sieves must be furnished with lead round their lower borders.

7th. The granulated and dried powder shall be enclosed in bottles covered with reeds; and these bottles kept in the powder store.

8th. The powder store shall be absolutely isolated; it shall be

provided with a lightning conductor. The only row of shelves which shall be placed there shall be placed at such a height that, in order to reach the bottles placed on the shelves, no mounting is necessary; the floor of this powder-room shall be covered with a sheet of lead.*

9th. No transference of powder must be made in the powder depôt, under any pretext whatever.

10th. The boxes in which the workmen enclose the bottles of powder shall be lined with leather, stuffed with wool or hair.

11th. Not more than a tenth, at the most, of the powder to be used in one day, shall be transported at a time into the charging room.

12th. The director of the establishment, and the superintendent of the workshops, shall alone have the key of the powder-room.

13th. The foreman should possess chemical knowledge, and present some moral responsibility.

14th. No workman younger than 18 years of age shall be employed; no workman shall be allowed to smoke in the manufactory or workrooms.

15th. No manufactory of detonating powder or caps shall have permission to be established without sending in before-hand an exact plan of all the internal arrangements, which, after their approval, shall not be changed, under any pretext, without a new authority.

On the substitution of a new material for the charcoal powder now in use in casting bronze and other figures, &c.

IN manufactories of bronze and other ornaments, of which there are many in Paris, and which cause the employment of a very considerable number of artisans of a high class, and who earn very considerable wages, there have been constant complaints made to the Conseil de Salubrité of Paris, of the serious attacks on the constitution, and the frequent diseases caused by the inspiration, in large quantities, of powdered charcoal.

This substance is employed, in very considerable quantities, for dusting over the inside of the moulds used in casting the bronze or brass objects, and to prevent the adhesion of the sand or clay to the fluid metal. When dusted out of a coarse canvas bag upon the mould, the atmosphere surrounding the workmen becomes perfectly black with charcoal, and as this substance is always used in the finest possible powder, it is taken into the nose, mouth, throat, and lungs with every inspiration. The complaints of the workmen of the ill effects of this on their health are loud and universal.

* The Council has proved that it is very difficult to cause fulminate of mercury to detonate when placed on sheet-lead.

I questioned several of the artists employed in this work, as well as some of the foremen, and from their evidence it appears that the following are among the principal effects.

The first symptom is a constant cough, evidently an effort of nature to rid herself of a foreign and irritating substance. This is followed by spitting blood, and being awake during the night with cough, accompanied with considerable pain in the chest. After a night attack of this sort the patient has no appetite, and resumes his work the next day without having been able to eat his breakfast.

They soon begin to find that the excretions from the nose and lungs become perfectly black, being evidently coloured by the carbon.

The men whom I saw employed in this work, especially those at Messieurs Eck and Durand's factory, in the Rue des Trois Borgnes, in Paris, looked ill and consumptive. They were wan, sallow, and very thin.

A very efficient substitute for the powdered charcoal has lately been discovered, which has been tried and found to answer the purpose as well, in every respect, as the charcoal, while it is free from the evil consequences of the latter. This is the finely powdered fecula or starch of potatoes. The workmen, as well as the foremen who had employed it, all assured me that it prevented the adhesion of the substance of which the mould was formed to the hot metal; that it made the surface of the casting equally as fine and smooth, and that it did not cause the great irritation of the lungs and mucous membranes induced by the present process. The Academy of Sciences has judged this to be so great an improvement as to be worthy of reward from the Montyon fund for rendering more healthy noxious trades and occupations.

I am of opinion that this knowledge should be disseminated among persons engaged in similar employments in this country.

On the hygienic conditions of nail makers and iron founders.

DOCTOR F. X. Masson has made a most valuable series of observations, confined, however, to French Ardenne, which bear particularly on a population employed in working iron, and especially nailery and iron foundry, the two great industrial employments of the Canton of Charleville.

These observations I now proceed to condense in this paper.

Although the workmen of these two industries have many points in common with each other, they nevertheless present in the conditions of their existence some curious peculiarities.

Nailers.

The nailers of Ardenne, united generally in groups of six or seven, associate together to work in the same workshop, at the

fire of the same forge, the bellows of which is set in movement by a dog. In these shops the nails are made with a hammer by hand, and the head of the nail by means of moulds or matrices in steel, called *clouières*. The iron made use of has been previously drawn out in long stems, the thickness of which is proportioned to the species of nail required to be made. A block of hard wood is fixed in the earth, close to the forge and in front of the workman; on this block are placed, in a fixed and invariable manner, 1st. What is called the place—a small anvil for drawing out the nails; 2d. Another little anvil to dress the nails; 3d. Scissors for cutting them; 4th. the *clouière* for forming the head, and for finishing it. The other instruments of the nailer consist of two pinchers and the hammer already spoken of.

Children are placed at the forge a long time before their physical development is fully operated, sometimes as early as seven or eight years of age; and, in certain communes, young girls themselves make nails long before the age of puberty; and one sees men, women, and children, all mingled together, working from morning to night. Placed in half circles round these forges, the fire of which warms them in the winter, lights them in the long evenings, and which often cooks their food, the nailers strike uninterruptedly and with repeated blows on the iron from which they manufacture millions of nails of a hundred different kinds. In a state of complete immovability of the legs, in a continual movement of the arms, with a perpetual balancing of the body, they thus pass their lives in the midst of the sulphurous vapour of coke, and of an atmosphere heated by the forge, and vitiated by the emanations of human beings and the dejections of dogs. Under such influences, the physical constitution of the nailers deteriorates, and there results from these circumstances certain special deformities that it is of great importance to point out, with a view to their correction and prevention.

The nailer has raised shoulders, and the left is higher than the right. The trunk is inclined to the same side, and the weight of the body, inclining in this sense, bows the corresponding leg, which causes the nailer to be uncertain in his walk, and to limp often in a marked manner.

The hands are deformed, especially the right; it has this constant character, that the fingers are curved inwards, so as to form an angle with the metacarpus, and so as not to permit the index finger to oppose itself to the thumb; thence the impossibility of raising a piece of money from a table in the ordinary manner, and the necessity of bringing it by the edge of one hand into the other, as is usually done for small seeds or pulverulent substances. This peculiarity will make a nailer be recognised anywhere, as also will the odour of dogs impregnating his clothing. A very common infirmity with those who make nails, is a contraction of the fingers, and even of the hand, which does not permit of their extension or opening; this obliges them in certain cases to take the hammer in

the left hand to insert it in their right hand when about to use it. If, besides, it is considered that the manufacture of nails is injurious to the growth of the individual who gives himself up to this industry too young, it will be easily understood why there are in the Canton of Charleville so great a number of nailers, mean in appearance, undersized, slender, and out of condition by their size, their infirmities, the feebleness of their constitution, to furnish soldiers for their country.

The vices of construction and the bad arrangement of the workshops exercise likewise an unfavourable influence on the constitution and the health of the workmen. They are almost always too small, and not sufficiently lighted or ventilated, and the extreme carelessness of the nailer augments still more the inconveniences which result from their faults of construction. They are but rarely cleansed, and the excrements of the dogs are allowed to remain there much too long. Hence arise disagreeable emanations, that peculiar odour which impregnates the very garments of the workman, and cause him to be easily recognised as a nailer by those who are accustomed to them.

Potatoes form the basis of the ordinary food of the inhabitants of the Ardenne; they constitute, together with coffee, bread, a few vegetables, a little butter or grease, all the nourishment of the nailer during the entire year. Coffee is in general use, it is the breakfast of every one, of the poor as well as of the well-to-do workman, and of the rich man, and in certain families it forms, so to speak, the whole day's nourishment. There are even women who have so strong a passion for this liquid that they drink it from morning to night. However, the coffee of the Ardenne is a liquid scarcely coloured with chicory, or but slightly flavoured with true coffee, without sugar, or scarcely sweetened with treacle or brown sugar. The nailers say that their coffee appeases their thirst well, that it prevents their being dry, and that without it they would be unable to support the heat of the forge during the heats of summer.

To terminate what is to be remarked about the hygienic habits of the nailers, I will add that the working garments of the men and women are not sufficient to protect them from the sudden changes of temperature to which they are exposed.

Iron Founders.

These artizans are employed in making objects of iron, as shovels and pinchers, window fasteners, screw-bolts, screws, screw-nuts, bolts, and spring-plate bolts.

The iron-workers are distinguished from the nailers by their physical powers being less changed, less vitiated, and by possessing more force and vigour of constitution. They owe this happy distinction to the very nature of their work, which is less painful and more varied. The workman in iron is not constrained, like the nailer, to preserve constantly and necessarily the same

position. Whether he forges, or files, or worms, or turns, or polishes the thousand and one objects that he manufactures, he has moments of inaction, instants of repose, which allow his limbs the momentary liberty they require, and the changes of posture so necessary to them. The workshop that he occupies is also always much larger and better aerated than that of the nailer, and consequently much healthier.

If we add, lastly, that the blacksmith earns higher wages, that he enjoys more comfort, and is better fed, it will be easy to understand the differences remarked in the constitution and the health of the two classes of workmen.

The maladies to which these two classes of whom we have spoken are subject, present some interesting peculiarities, which it is desirable to indicate.

Ophthalmia is very common among iron founders, and especially among nailers, whose sight is fatigued by the vacillating fire of the forge, by the brightness and heat of the fire, by the fineness of the objects they manufacture, and by the fixity of their looks on these objects. It is in a great measure to repeated inflammation of the eyes that many of these workmen owe, towards the end of their days, this feebleness of vision that puts them out of condition to work.

Coryza, which is usually so simple a complaint, assumes sometimes with iron founders an extraordinary intensity, and produces most distressing symptoms. The inflammation prolonged into the frontal sinuses, and continually exasperated by the concussions of the hammer, gives rise to intolerable pains in the head, to fever, even to delirium, and sometimes endangers the life of the patient.

The continual acts of imprudence that the workman commits in leaving his workshop in a state of great perspiration, and in exposing himself, in an inconsiderate manner, with his arms naked, and in his shirt, to the cold and humidity of the atmosphere, frequently bring on catarrhs, pleurisy, and rheumatic affections.

M. le Docteur Masson describes also chronic inflammations of the liver, which he attributes "to the repeated concussions which the liver receives from the action of the hammer on the anvil, to the different compressions that this organ undergoes during the work, and still more to the excessive quantity of beer consumed, which disturbs the functions of the stomach, and influence, in a special manner, the biliary organ."

Lastly, two surgical affections are constantly met with in the iron founder, namely, inflammation of the axilla, and whitlow, caused by a blow, a spark of iron introduced in the flesh, a burn, or fatigue caused by using the hammer.

Certain other infirmities attack nailers and blacksmiths, especially the former; we will mention amaurosis, arising from the fact that the evening's work only takes place by the vacillating light of the forge, and by the lively and fugacious brilliancy of the red-hot iron withdrawn every minute from the furnace. Also difficulty of hearing and deafness itself, which are explained by the fatigue

undergone by the organ of hearing; the result of the continuous and monotonous noise of the hammer; dyspnœa and asthma, depending on the maladies already described, and varices produced by the continual vertical position.

But Dr. Masson does not confine himself to this sad enumeration of inconveniences, of dangers, of diseases and infirmities to which the Ardenne nailers and forgers are exposed; he endeavours to make known remedies for them. A first observation, full of interest, and which deserves particular attention, is that the bad manufacture of the tools and the very faulty manner of using them have a direct and very active influence on the alterations and deformities with which the nailers are afflicted. On this subject it is extremely interesting to attend to the useful reforms proposed by M. Vitasse, a former journeyman nailer, whose intelligence and energy has raised him among the ranks of the most distinguished masters.

According to M. Vitasse, "the apprentice becomes deformed, bent forward or to one side, because the working instruments which he uses are out of proportion to his strength and his size, and that for the most part they differ in no manner from what an adult would employ. The block of wood on which are fixed the anvils &c., should be neither too high nor too low; the "place" and the "pied d'étape" inserted in the block should be on a level with the hip of the workman, and these two tools should only be separated from each other by a distance of eight hundreds of a metre.

"The hammers which the nailers use are generally too large and too heavy, and they are badly made. For a child ten years old, the hammer ought not to be more than 625 grammes=1 lb. 6 oz.; for a child twelve years of age, 700 grammes=1½ lbs.; of eighteen years, 1 lb. 9½ ounces, or 750 grammes. It is necessary that the hammer should be curved on itself towards the handle, and that it should end in a head broader than the body of the instrument. The actual form of the hammers is such, that the spangles of red-hot iron in a state of incandescence are thrown on to the hand of the workman, who, fearing lest he should be burnt, especially on commencing the business, works with less assurance and more hesitation; and when he feels the pain of the spark, he stops, disturbs his work, and does it with less celerity and precision.

"The handles of these hammers are too short and too thick; which, joined to their weight, requires too great a contraction of the hand, and explains the infirmities of this organ, and the contraction of the fingers that have been described.

"The nailer should stand on a level floor, in order that the body may have a solid basis, and a regular point of support.

"The points of the feet should be slightly distant from each other, and a little sloped forward. This is just the contrary of what generally exists in workshops, where the heels finish at length by forming for themselves a hole in the soil, which keeps them beneath the level of the fore part of the feet."

If these precepts were followed, the nailers would no longer be exposed, as they now are, to the incurable deformities, and to precocious infirmities, which arise from their badly-conducted work. Dr. Masson adds to these practical propositions very wise suggestions touching the necessity of not admitting to apprenticeship children under twelve years of age at the least; to render the workshops of the nailers more healthy by cleanliness and better ventilation; to make their food more substantial, their clothing warmer, and lastly, to combat excesses of all kinds, and the prejudices which contribute to ruin their health, and to perpetuate their daily habits.

In our opinion, this remarkable essay should be widely known, as we are persuaded that it should serve as a model of such an important study as professional hygiene, and because it demonstrates in the most striking manner, even in a limited question, how the exactness and the novelty of the recommendations, the spirit of observation, the sagacity of the precepts, may serve with great utility both science and humanity.

On the diseases of the workmen employed in the manufacture of chemical matches, and the laws regarding them.

THE study of the diseases to which the workmen employed in the manufacture of chemical matches are exposed, has given rise to very curious observations, although still surrounded with some obscurity.

Doctor Hyfelder, Messrs. Théophile Roussel, Strohl of Strasbourg, Sédillot, &c., have described examples of a very peculiar affection, due to the action of phosphoric vapours, an opinion, however, which has been contested by M. Dupasquier of Lyons.

In examining the accidents which arise to the health of these artisans, in endeavouring to ascertain what are, in the manufacture of matches, the peculiar conditions capable of exercising on the living economy a disastrous influence, one cannot but attach the greatest importance to the emanations of the phosphoric vapours which are continually being given off in variable quantities in all the manufactories where either the mastic of the matches, or the matches already charged with the mastic, are handled.

The careful study of the different parts of the work carried on in the factories, permits it even to be affirmed that the emanations of the phosphoric vapours is the only one that causes the accidents and diseases which afflict so great a number of the work-people.

That is why it is necessary first to examine the two following questions, viz:—

1st. What are the parts of the manufacture of these matches, which cause necessarily exposure to the phosphoric emanations?

2d. What are the nature and the chemical composition of these emanations?

All the wood work and the manufacture of the boxes generally take place outside the factory; these operations are consequently not concerned in the questions of hygiene and pathology which now occupy us; and as they occupy about half the total number of workpeople employed, it follows that half the number of these operatives are beyond the sphere of action of the causes of insalubrity inherent in the factories.

In the interior of the factories, in admitting that there is a particular locality set apart for each operation, five-sixths of the workpeople may therefore escape the influence of the phosphoric vapours. Thus all the work of filling the presses, which absorbs the four-fifths of the women, may go on in rooms free from the emanations, since dry wood is the only substance they are concerned with.

There remains to examine the workshop where the mastic is made: that where the matches are dipped; the stove-room; and lastly that where the presses are emptied and the boxes filled.

The atmosphere of these various rooms is charged in a more or less intense degree, by the vapours which rise either from the paste into which the matches are dipped, or from the heaps of matches already charged with the phosphoric paste.

The pounding of the materials, and the preparation of the mastic, do not require continuous working: a single workman suffices for those operations; besides, these are frequently carried on in the open air, so that they are not of very great importance in a hygienic point of view. One might almost say as much of the stove work, where the workmen do not work continuously.

But it is not at all the same with regard to the “steepers,” and above all, with the work-rooms occupied by the emptiers of the presses, and the work-women who put the matches into packets and boxes. The stranger who enters this part of the manufactories, is struck with the emanations which en hale from them; the transparency of the air there is frequently troubled, particularly in the room where the presses are emptied, and if one remains there some time, a slight cough and burning in the throat is generally experienced. One gets accustomed, however, after a time, to this atmosphere, and the greater portion of the women, as we have been able to assure ourselves, only cough in moist weather, and particularly when the air is not often renewed, and the phosphoric vapours accumulate and become too thick.

These remarks, however, are only exact for those factories in which the work is well divided into distinct workshops.

As to the small establishments, where all is necessarily confounded together, and some large factories where we have all the opera-

tives working together, it is evident that all the operations are nearly equally unwholesome, and that the distinctions established above cannot apply to them.

The composition of the vapours which trouble the purity of the atmosphere in the workshops which we are treating of, has been indicated by Dr. Dupasquier.

He has found that they consist principally of hypophosphoric acid, probably mixed with small quantities of phosphuretted hydrogen. He has also no doubt that phosphorus itself is present in the state of vapour. This it is which shows this fact, pointed out by a manufacturer of matches, viz., that when the workmen who have passed the day in the midst of the vapours of phosphorus, are in the dark at night, the gases which they expel from the stomach become luminous, so much as to cause it to appear as if they breathed flames from the mouth.

The effects of these phosphoric emanations upon the health of the workpeople are :—

1st. Bronchitis more or less severe.

2d. Destruction of the teeth, and necrosis of the jaw bones, &c.

The cough is the pathological phenomenon, the most common and the most easy to point out in the factories of chemical matches; it is also the one that it is the most easy to connect directly with the action of the phosphoric vapours.

In the establishments where the work is better divided, one may assure oneself that the individuals most subject to the cough are the steeppers and the women who empty the presses, make up the packets, and fill the boxes. Moreover, as they themselves remark, these women cough most when the weather is damp, and when the air of the workshops is not renewed sufficiently frequently.

We have just said that the cough is a symptom very common among the workmen in matches; we must add, that it is not observed in all. Many say that they rarely or never cough; others that they had coughed during the early period of their entering the factory, but that they had finished by becoming habituated to the atmosphere of the workrooms; the greater part coughed, but only at intervals, and under the circumstances above stated. Many among them attached no importance to this cough, which gave them but slight inconvenience, and was accompanied neither with pain or expectoration. Although we must allow a great deal for the incurable carelessness of this class of men, it appears certain that the irritating action of the phosphoric emanations on the respiratory ducts only reaches great severity in a limited number of cases.

But these cases undoubtedly do exist; they have been observed in an incontestable manner in the hospitals of Paris.

Evidence obtained at Strasbourg by Dr. Strohl, confirms the accounts of the severe attacks of bronchitis above spoken of. This physician reports that the work-women have declared to him “that the phosphoric emanations were very irritating.” “A great number of them are seized with a cough, which is sometimes troublesome and continuous enough to oblige them to cease their work.”

Dr. Charles Lépine, who has furnished much interesting intelligence concerning the manufactory of chemical matches at Châlons-sur-Saône, in which ten workmen are employed, has remarked that almost all those who work in the large workshop, where the filling and the emptying of the presses take place, as well as the making up the packets, are attacked with a cough more or less intense, but which has not yet caused the cessation of work in any instance.

M. Roussel says, "I have not yet met, in the manufactories of Paris, any cases of real severity; but this ought not to surprise us, and we must not conclude from that that the effects of the phosphoric vapours have not the serious effects that M. Gendrin accuses them of. Patients, as seriously attacked as those of whom the physician to the hospital of "La Pitié" speaks, have necessarily quitted the factories, and are only to be seen in the hospital.

"It is necessary then to ascertain if the number of those whom cough drives from the factories is considerable. From the investigations we have made, we should be disposed to answer in the negative; we believe, at any rate, in the well-arranged establishments, that these cases are not very common.

"Nevertheless, in questioning the work-women, we have ascertained from a certain number of them, that several of their companions had been obliged, in consequence of *neglected colds*, to leave the factory; and in general, they added that these had become consumptive."

Dr. Roussel has particularly remarked a circumstance regarding the health of individuals affected with disease of the jaw bones, which appears to play an important part in the production of these diseases. It is, that in whatever state this disease is observed, the individuals had always several decayed teeth, and that all of them assured him they had had the teeth spoiled a longer or shorter time before the breaking out of the evil, and even in some cases before their entering the factories of matches. It suffices to notice the fact at this moment; the deductions therefrom will be seen further on.

It is worthy of remark, that all the individuals affected, had passed rather a long time in the factories before they were attacked with the disease. The patients of M. Lorinser had sojourned from four to nine years there. Those of Nuremberg had also remained there a long time, and they had worked fifteen hours a day. Those of M. Strohl and Sédillot, and those we have seen, had been at least two years at work.

We have found that the steeping and the other parts of the work which most predispose to cough, are also those which most predispose to diseases of the jaws.

It does not appear that any other organs or functions are interfered with in this kind of work.

Neither the digestive functions, nor the general nutrition, nor the organs of generation appear at all affected.

M. Dupasquier doubts the influence of the phosphoric emanations. He appears to attribute to arsenical vapours the diseases

observed in match factories; but there is nothing to authorize this conjecture, and it is most perfectly certain that the influence of the manufacture of chemical matches is essentially injurious to health.

HYGIENIC RULES.

The following regulations with regard to the manufacture, transport, and sale of chemical matches have been made by the Council of Health of the Department of La Seine.

Sites of factories.

The buildings intended for these manufactures shall be detached.

The magazines and workshops to be on the ground floor.

The drying and cutting of the wood can only take place in a building separate from all the other work-rooms.

Magazines of raw materials.

The following store-rooms must be separated from each other by a brick wall.

1st. Phosphorus store. The phosphorus must be kept in tin boxes plunged in a reservoir filled with water, and of a size fifty times at least larger than the boxes of phosphorus.

2d. Stores of chlorate, solid gum, glue, prussian blue, and cinnabar. These substances must be enclosed in bottles, barrels, or boxes.

3d. The sulphur must be in rolls, if the sulphurisation of the matches takes place in the same factory.

Isolated distinct work-rooms.

1st. Room for mixing the phosphoric paste. Only enough of the materials of the paste for a single operation must be kept here.

On the floor of this work-room a reservoir, containing at least 250 quarts of water, must be kept, to be ready in case of accident of fire.

2d. Room for powdering the chlorate of potass and the colouring materials. This room must be in the neighbourhood of the last-mentioned one.

3d. Room for sulphuring and dipping the matches. This room must be separate, ventilated, and properly constructed of bricks.

4th. Stoves for drying the inflammable paste. They must be built or lined and arched with bricks; they must communicate at the upper part with a solid chimney, rising above the neighbouring roofs.

The doors of the stoves to be of strong sheet iron in framework of iron, and to open outwards.

The bottom of the stoves to be constantly covered with a layer of fine sand, 4 or 5 centimètres thick.

5th. Room where the presses are emptied. The matches withdrawn from the presses to be immediately packed. This room to have two doors at the disposal of the workmen; the doors to open within.

6th. Room for packing.

PREPARATION OF THE EMULSION CALLED PHOSPHORIC PASTE.

The addition of flowers of sulphur in the emulsion of the phosphorus is strictly forbidden.

The emulsion is to be prepared in this manner: the solution of gum is to be brought, having been warmed in a neighbouring room to 75° or 80° cent.; this solution is to be poured into a copper matrass, solidly fixed in the circular opening of a table or dresser.

The melting and dilution of the phosphorus to take place in small quantities, added successively in the matrass, till the gummy solution fills the vessel two-thirds.

The beating is not to be commenced until after the cessation of the sparks produced by the phosphorus, that is to say, when the temperature of the mixture has descended to 60° cent.

Powdering the raw materials.

The chlorate, if employed, should be steeped in a solution of gum before being submitted to powdering.

The colours, resins, &c., shall likewise be powdered separately with the same precautions.

Sulphuring and dipping.

The furnace for melting the sulphur, and for heating the ends of the matches, must be isolated; the heat to be transmitted by means of a water bath containing a solution of chloride of zinc, or of a sand bath.

The temperature of the liquified sulphur must not be carried beyond 140° centésimaux.

A cover, easy to put on, which will allow of the closing of the boiler, and to stifle instantly the fire which would seize on the sulphur, in case of the accidental contact of a burning substance, must be used.

Drying the inflammable paste.

The presses for holding the matches must be of iron or sheet-iron.

The cushions separating each row of matches may be of card-board and wool joined by glue.

The door of the drying house to be kept open all the time of work.

The warming of the drying-room to take place by means of hot water. The fireplace to be external

GENERAL MEASURES.

Every evening the débris of the matches to be burnt in small portions. The fireplace for these burnings to be placed in an angle of the wall of the courtyard; and if this is impossible, the débris to be transported in covered vases to a locality where these precautions are practicable.

After the workmen have left, all the parts of the fabric shall be visited; the floors to be swept clean.

The fires shall be extinguished, and all the hearths and stoves shut, either with sheet-iron doors or with bricks.

No stores of wood, paper, cardboard, sulphur, or other combustible matters can be kept in the workshops or drying rooms.

PACKING AND SALE.

Matches, inflammable by friction, shall be delivered in closed envelopes of wood, pasteboard, or tin.

All manufacturers and dealers are prohibited from fastening up the said matches in packets packed in boxes containing above 400 each.

On the diseases of shoemakers.

THE occupation of a shoemaker is one of the most painful and laborious among those carried on by sedentary artizans. It is exercised frequently in unhealthy workrooms, and exacts a position and movements which leave on different parts of the body indelible traces.

Perched from morning to night upon a stool, the body bent in two, they exert great force in laboriously sewing leather. Consequently the right hand, the thumb and index finger of which draw out the thread in order to cover it with wax, have the pulp flattened; the pulp of the thumb is rather pushed on one side. The fold which separates the second from the third phalanx is cut by the thread, and presents a deep crack, the borders of which are hard and callous.

On the left hand, the pulp of the thumb, also pushed aside towards the index finger, has the form of a very broad spatula, and the nail is considerably thickened and hard; its free edge is toothed, frayed, scratched, and sometimes deeply grooved by injuries of the awl.

Moreover, the pressure of the last on the chest causes, in spite of the interposition of a plastron of leather, a sinking in of the chest at the level of the chondro-sternal articulation of the sixth, seventh, and eighth ribs, immediately below the ensiform cartilage. The sternum shows at this spot a hollow, deep, regular, circular, clearly described, and which is not accompanied with a general malformation of the entire thoracic cavity. Lastly, one of the thighs upon which is fixed a plug of leather presents a flattening of the skin, and particularly of the hairy bulbs, which become obliterated, so that this part often appears quite smooth.

The sedentary position, and the unwholesomeness of the workshops or rooms where the journeymen shoemakers work, add to the causes of physical deformity we have just enumerated, to produce in these artizans certain constitutional affections, which are aggravated by their hereditary tendency. Rickets and scrofula are strong instances of this.

Corvisart and Mérat look upon shoemakers as liable not only to chronic inflammation, but also to cancer of the stomach. Stoll adds hemorrhage of the lungs. Turner Thackrah attributes to their fatiguing position a troublesome compression of the bowels, and especially of the stomach and liver, and as a consequence, constant disorders of the digestion and circulation, and a marked impoverishment of the blood. He lays it down as a fact that few artizans of this class live long.

It must be acknowledged that few occupations have been the object of less improvements, and that those improvements even that have been proposed have been received with the most deplorable indifference by the artizans to whom they were addressed. Thus there has been invented in England a kind of bench, which, by permitting the workman to work upright, delivers him almost completely from the inconveniences of the position and the motions which now so greatly incommode him: but this invention has borne no fruit. A more radical modification would have consisted in the application of machines for the manufacture of boots and shoes, as proposed and put in work by M. Brunel. There is, besides, much progress to be made in giving to the shoes actually worn the qualities in which they are so deficient, and especially a form better appropriated to the structure and mechanism of the human foot.

*On certain deformities to which tailors are
peculiarly liable.*

THERE are few occupations in which, in addition to the accidents produced by the sedentary nature of their employment, physical deformities so decided and well marked are met with as in tailors.

In consequence of the particular attitude in which they work, constantly sitting, the legs crossed, and the body bent forward, there arises on both sides:

1. A red swelling, more or less voluminous, sometimes as large as a walnut, and very soft, on the outer ancles;
2. A second tumor, resembling, but smaller than the former, on the outer border of the foot, at the level of the tarsal extremity of the fifth metatarsal bone;
3. Lastly, a reddish-coloured hardness on the small toe.

In young workmen, who have not been very long in the trade, instead of tumors, we find simply a bright redness, very circumscribed, accompanied with slight swelling.

Besides these characteristic deformities of the lower extremities, tailors present at the lower portion of the chest a considerable depression, caused by the curving in of the chest.

This depression, which may be compared with that seen in shoemakers, is, however, very distinct therefrom.

Placed lower down, *beneath* the ensiform appendage, it is not limited to one point of the sternum, but results from a deformity of the whole of the thorax.

On the diseases of carders of flax, hemp, wool, silk, &c.

THE carder is the workman employed in *carding*, the operation certain filamentous matters are made to undergo, in order to render them fit to be spun, or even simply to extract foreign bodies from them, and to give them elasticity. It is on flax, hemp, wool, and silk that this industry has to work.

Carding may be done either by hand, by means of two *cards* with handles, or by means of sticks with which they strike the wool, spread out on screens; or lastly, by means of mechanical apparatus.

The inconveniences arising from cardage have been thus summed up by Dr. Boileau de Castelnau, in a report addressed to the Minister of the Interior, on the influence of the cardage of silk on the health in the prisoners of Nismes.

“Position, constantly sitting or standing for the pressers; forced and continuous exercise of the upper extremities; continual inhalation of vapours and particles of animal matter; obligation to keep the hands at the elevation of the head.

“To these must be added other ordinary causes of insalubrity, as damp and inadequately ventilated workrooms, temperature hot and stifling, the transition from an atmosphere of this kind into a sharp and cold air.”

Fourcroy and Sarthe class the profession of wool-carder among those which injure health by the excessive exercise of certain parts, (the upper extremities,) and by deficient exercise of other parts, (the lower extremities), by the particles of soap which the workmen inhale, and by the animal molecules which enter the aerial passages.

It is especially the noxious substances which pollute the atmosphere breathed by the workmen in carding, which have fixed the attention of observers. Morgagni, Fourcroy, Ramazzini, have reported numerous examples of severe or mortal affections developed under such an influence.

Cruel maladies, say the authors of the “*Topographie de Nismes*” afflict the “*bourretaires*” or carders of floss silk. All are exposed to weakening and to œdema of the lower parts of the body, to chronic pains of the arms, the shoulders, and the chest; many are subject to the most painful affections of the eyes, such as acute inflammations, obstinate ophthalmia, &c.; the greater number are threatened with long and fatiguing coughs, with asthma, spitting of blood, and pulmonary consumption, &c. To these must be added cutaneous diseases, due to the irritating and contact of dirty substances which fill the atmosphere of the carding rooms, and which attach themselves to the skin and the clothes of the workmen.

Many physicians, practising in localities where the industry of carding occupies many arms, give the following as the portrait of the journeyman carder.

One recognizes the carder by his countenance, pale, etiolated, wan, rather bloated than fat; by his red eyes, and his almost

constant cough. The maladies to which he is subject are, chronic ophthalmia, hypertrophy of the heart and its consequences, consumption, varices, atonic ulcers. The most skilful and intrepid artizan is forced to discontinue his trade at the age of 48 or 50. Carding, besides, in many localities, is only carried on during three or four months of the year, from November to the commencement of March, and alternates with field labour.

The above observations apply more or less directly to the different kinds of carding. We should add to the circumstances we have alluded to, that in certain cases the molecules which spread in the air get accompanied with certain substances which add to their injurious effects. Thus Fourcroy has seen, in the case of a woman employed in carding a mattress belong to a brazier, particles of copper that the wool of the mattress contained, introduce themselves into the bronchial tubes and give rise to serious symptoms of poisoning by copper.

M. Boileau de Castelnau, who has studied with care the influence of silk-carding on the health of the prisoners of Nismes, has certified, that the carders have contributed more entries to the infirmary than all other professions united; that if this profession has given fewer deaths, it is, that before dying the carder has changed his occupation, because he had no longer strength to continue it; that half the men who entered the infirmary were or had been carders; that consequently this occupation was more injurious to health than the others.

The industry of carding reclaims, therefore, imperiously the employment of machinery, in order to remove the operatives from a fatal influence. Nevertheless, it is possible to diminish these dangers by certain precautions.

Remedies.

In some parts of the Cevennes the carders cover the mouth with a handkerchief. In the work-rooms of Piedmont screens of canvas are suspended horizontally at a certain height, between the ceiling and the heads of the workmen, to catch the dust disengaged by the carding. These screens must be removed every night and carefully cleaned. It is of importance that the work-rooms should be lofty, large, ventilated by means of broad windows, close to each other, and placed opposite to each other. These windows must be opened on the side opposite to the direction of the wind. Fourcroy advises the workmen to place themselves with their backs to the wind, so as not to swallow the murderous dust. Great cleanliness of face and hands, and the use of a blouse and hat of linen or canvas, which should be removed when the day's work is finished, would tend to prevent the diseases of the skin that the contact of animal dust as well as vegetable so frequently determine.

On disinfecting and the action of disinfectants.

Disinfection.

THE air is said to be *infected* when it contains odorous and unwholesome principles, such as sulphuretted hydrogen, ammonia, or carbonate of ammonia; or when the proportion of its normal constituents other than oxygen, as nitrogen or carbonic acid, is augmented; or again, when it contains substances almost unknown in their nature, but whose existence is not the less certain, and which are known by the name of miasm, emanations, or effluvia. The term "disinfection" is given to the operation by the help of which one endeavours to destroy the noxious qualities of the air; and the substances made use of for this end are called "disinfectants." This name, however, must not be given to substances which only act by masking the bad odours of the air, and which belong to the class of "fumigations."

The substances which truly deserve the name of disinfectants are, according to M. Fermond, those which, by some chemical action, destroy or neutralize the foreign materials which injure the wholesome properties of the atmosphere.

It may be established generally :

1st. That the acids (nitric, hydrochloric, &c.) act frequently with much efficacy in neutralizing ammoniacal animalized matters, or even in chemically modifying these matters. They have been frequently employed with success in purifying large inhabited buildings.

2d. That chlorine and the alkaline hypochlorites, the best disinfectants known, decompose all organic matter by seizing their hydrogen.

3d. That the alkalis (ammonia, quicklime, potass, soda, &c.) act particularly by neutralizing acids, as carbonic, hydrosulphuric, and especially the organic acids whose nature is as yet but little known.

4th. That nitrous and sulphurous acids produce, in many cases, excellent effects in disoxygenizing organic substances.

5th. That, in all cases, ventilation is an indispensable complement of all disinfection.

It is usually to chlorine that recourse is had to disinfect hospitals, although either nitrous acid or nitrous gas may be employed.

Earthen saucers, in which has been placed previously a mixture of *four parts of sea salt* and *one part of peroxide of manganese*, on which is poured every now and then two parts of sulphuric acid diluted with an equal weight of water, are placed here and there.

The saucers are placed on hot cinders, so as to keep up the disengagement of the gas during several hours.

When it is time to wash the bed frames and the walls, chloruretted water, formed by mixing one part of dry chloride of lime with twelve of water, allowing time to deposit, and then straining it, must be used for that purpose.

The process for obtaining chlorine above given cannot be made use of where invalids are present, on account of the irritating

action of the chlorine on the respiratory ducts. When it is desired to disinfect wards filled with patients, we must be satisfied with placing at small distances from each other open vases containing a concentrated solution of chloride of lime, so as to obtain a feeble disengagement of chlorine.

The disinfection of drains consists, properly speaking, in a good use of ventilation and irrigation. The chlorides or the disinfecting fluid of M. Paulet, may also be usefully employed.

It happens sometimes that dépôts of putrid matter, as manures and cesspool matter, disengage, especially when they come to be stirred, a fetid odour very difficult to be borne. It is sufficient then to water them with chloride of lime suspended in water, to cause all odour to disappear. The same substance may be employed in dissecting theatres, and in rooms of exhumation.

Charcoal is also employed in analogous circumstances; but it acts then more as an absorbent than as a chemical agent. In Mayenne, the agriculturists understand well how to utilize faecal matter to manure their fields, and with this object, they dry a quantity of earth, generally peat, reduce it to powder, throw it into the privies, stir it, and thus obtain a pulverulent matter completely disinfected.

Clothing, counterpanes, mattresses, impregnated with infected odours, or which are supposed to be contaminated by noxious miasmata, should be, according to the process recommended by M. Chevallier, suspended in a wardrobe where plates containing dry chloride of lime are placed.

Or they may be left with a solution of chloride of lime, or better still, if they are woollen materials, with an aqueous solution of chlorine, alkalis having the property of attracting and even of dissolving wool.

As to the disinfection of air vitiated by principles whose nature is unknown, means purely empirical must be resorted to, whose efficacy is at least doubtful: as acid or alkaline fumigations, chlorine or alkaline hypochlorites, aromatic or resinous fumigations, fires lighted in open air, gunpowder exploded.

We have spoken above of the use of charcoal for disinfecting faecal matter. In fact, placed in a condition of suitable subdivision, charcoal completely destroys the odour of putrescent organic substances. Animal black or charcoal is particularly extolled for this use; but it is not only in this form that charcoal is employed as a disinfectant.

When charcoal at the ordinary temperature is placed in contact with water, some organic substances in a state of decomposition which give it an infected odour, it can so completely destroy this odour, that if the water contained no saline substance to give it a particular taste, it would become perfectly drinkable; but after a certain time, it might take on again a repulsive smell, if the organic matter contained in it underwent a fresh change which would give rise to the formation of gases of the same nature as the first, and that the charcoal was not in sufficiently large proportion to remove entirely.

It is on this property that is founded the use of charcoal for purifying the water meant to serve as drink, or to preserve it during sea voyages.

On the dwellings of the labouring classes in manufacturing towns, as regards their sanitary conditions.

No one can be ignorant how great are the sacrifices that the labouring man and the poor man must make for their dwellings. Whilst all other articles necessary for their preservation have greatly diminished in cost, whilst food and clothing have undergone a great fall in price, the expense of lodging in our industrial towns has risen enormously, and threatens to rise still more; and although wages have much increased, it is only with very great difficulty that the workman can support so heavy a charge.

The problem that the workman has to resolve is, how to provide for the necessities of habitation with the least possible sacrifice.

If the care of his health and that of his family occupies him but little, because, robust and healthy up to that time, he believes they will remain so; if he is ignorant of the causes of sickness and infirmity, that a narrow, damp, confined dwelling conceals; if, a stranger to large towns, he enters one with numerous and healthy, strong children, that the mephitic atmosphere of a manufacturing town has not yet emaciated, he will bury this fine family at the bottom of a narrow court that the sun never brightens, and on which weighs incessantly a fetid and stagnant atmosphere; lucky if, to save a few pence per month, he does not descend into a hideous cellar—a living tomb.

But if the poor man and the artizan show but little care for the preservation of their health and that of their family, it is the duty of those in authority to look to the future generations of the people. The interest of governments as of industry requires it.

Causes of insalubrity in the dwellings of the poor.

There are two distinct divisions to make in lives of artizans: 1st. External life, or that which a man passes out of his habitation; 2d. Internal life, that is to say, that of his family—his home. This latter is the object of our present study.

The time passed at home varies for different members of the family. The infant, up to a certain age, scarcely ever quits the house. Arrived at youth, his time is divided between the school or the workshop and home. The mother of the family is almost always at home, and therefore the influences resulting from the insalubrity of the house act upon her with great energy; and whilst the father and the grown-up children experience the good effect of fresh atmosphere in their entrance to and their leaving the workshop, the mother, constantly subjected to the action of a concentrated and impure air, becomes emaciated, vegetates miserably, and often bears the stamp of premature old age.

As to the aged poor man, a being worthy of the greatest solicitude and compassion, his latter years, which are often but a slow

agony, are passed in the house. He lives almost without air and without light, hidden in a dark corner, waiting, in company with his numerous infirmities, for an epidemic disease or an acute affection to carry him off in a few days, incapable as he is of resisting the attacks of the one or the other.

For all classes and ages, there is the long sojourn of the night, the time of sleep occupying nearly half the existence of man.

There are three principal causes of the vitiation of the atmosphere of our dwellings. They are—

1st. Respiration.

2d. The exhalation which takes place from the surface of the skin by insensible perspiration.

3d. The excretions.

The two former have been long studied, but the effects of the latter have not been so minutely inquired into as the great importance of the subject demands.

We propose to give it some consideration in this place.

The greater part of the habitations occupied by the poor have privies common to all the inhabitants of the house.

Some are kept cleanly enough; there is a sort of surveillance over them, and they are pretty frequently washed; but these are but a small proportion, and the others, situated ordinarily at the bottom of narrow *and dirty yards*, add materially to the other causes of a poisoned atmosphere. They are but rarely washed; remains of animal and vegetable matter are thrown there daily by the numerous inhabitants of the neighbourhood, and these different matters thrown in give rise to a disengagement of gaseous products more deleterious and more infectious than those produced naturally.

The gases furnished by the secretions of man are of several kinds; and as the effects that these produce are various, it is necessary to determine their nature, and to characterise their action separately.

1st. The peculiar odour that the excretions of man exhale, shortly after their emission, is produced by the presence of sulphuretted hydrogen gas.

2d. After these matters have been evacuated some time, and when they are mixed with a certain quantity of urine, this liquid, by its decomposition, gives rise to a disengagement of ammoniacal gas; and the mixture of these two products gives rise to a new combination,—hydrosulphuret of ammonia, the effects of which upon man, when this gas is introduced into the respiratory passages, are much more serious than the inspiration of the two former separately.

The former gas may be perceived in apartments where the excrementitious matters have sojourned some time; but the hydrosulphuret of ammonia requires for its production a longer time, and it is only met with in dirty privies, the cesspools of which are badly constructed, and which, too small for the population they are intended to serve, are filled too full and *emptied too rarely*.

Several other mephitic substances, pernicious to mankind, are

met with in these places, when the air is not properly renewed ; but only two kinds of mephitism have been distinguished. The first is produced by the hydrosulphuret of ammonia. This is the most common and the most terrible. It is in the inside of the privies, and by the agitation caused by their evacuation, that the most serious and sudden accidents are produced ; and then also the perfidious effects of this gas may make themselves felt beyond a certain distance. In some cases, an instantaneous death has followed the respiration of this gas ; an extreme irritation has seized the eyes and the throat, and has brought on suffocation.

The second species of mephitism is produced by the presence of too great a quantity of nitrogen. This gas is unfit for respiration. The chest is oppressed by it, its movements become progressively slower and more difficult, and death takes place by asphyxia. In the neighbourhood of privies and cesspools this gas scarcely ever produces effect rapidly fatal, because, whatever may be the amount of the concentration of the air of the neighbouring places, it will be always in sufficient quantity to allow respiration to take place. However, in all places where nitrogen exists in excess, it always produces a certain difficulty of breathing.

It is a mistake to suppose, as is generally done, that if a candle will burn in an atmosphere in or surrounding a privy, that it is therefore fit for human respiration. This gas, sulphuret of ammonia, will permit bodies in ignition to continue burning almost as freely as in common air, and still be mortal to man.

The only gaseous substances for which a lighted candle is a test are carbonic acid and nitrogen. The latter is more frequently met with in privies than the former, and it is also the gas which more often vitiates in the abode of man the concentrated air breathed there.

Vitiation of the air by the domestic animals which live near man.

It is not rare to find, in the habitations of the poor, animals brought up close to him, sometimes in considerable number. This is more particularly the case in the houses of the poor that surround towns. Sometimes they are birds, whose cages cover all the walls of the narrow dwelling, sometimes dogs or guinea pigs, but the animals we generally meet with are rabbits. Generally, a very considerable profit is derived from these animals. It is unfortunately generally the very poorest and most insalubrious homes where they are found in the greatest number.

It is important that the labourer should be informed of the dangers to which he exposes his family in preserving such guests in his house.

The respiration of animals enclosed in a limited space changes the air in the ratio of the oxygen they absorb. This amount is not equal for all, and observation has proved that birds consumed a much greater proportional amount of oxygen than other animals larger in size.

The exhalations from the surface of the body of animals, their insensible transpiration, their excrementitious matters, frequently left to accumulate in a corner on a damp soil, these are additional causes of the vitiation of the atmosphere.

Serious consequences frequently arise to the health of the poor and their families from this state of things.

Influence of light and warmth.

Another condition absolutely essential to the preservation of the health of man, is the influence of light.

The action of light on man is incontestable. The continual enjoyment of its beneficent influence renders us, in some measure, indifferent and insensible. To appreciate its effects, however, it is enough to consider what effects are produced by obscurity on all beings endowed with life. Vegetables withdrawn during a sufficiently long time from the action of light grow with slowness, and are weak; their softer tissue becomes impregnated with a larger quantity of water, and has a tendency to become dropsical. All animals, as well as man, suffer from privation of light. Every one knows the miserable and wretched life of miners, the smallness of their size, the deformities of children occupied in mines, the extreme pallor of their countenance, the meagre appearance, and their frequent early-developed dropsy.

Those inhabitants of manufacturing towns that live in cellars participate, to a certain degree, in these results.

Heat is necessary to life. Man possesses within himself the faculty of developing the amount of caloric necessary for his preservation; but as he is unceasingly exposed to exterior causes which tend to modify that amount, he also possesses the force of reacting against the influences which tend to lower the temperature, in the same manner as, when exposed to the action of a high temperature, he can diminish the effect that it exercises on him by producing on the surface of his body a transudation which is continually evaporating, and thus moderate the enervating influence of this cause.

But this faculty of reaction has its limits, and man is provided with artificial means for satisfying this want. Besides, he does not possess at all ages this force of reaction in an equal degree; if it is powerful in the adult, it shows itself, in the extreme ages of mankind, in the infant and the old person, enervated, insufficient, and the action of artificial heat is then necessary.

In the narrow and confined habitations of the poor, heat and cold often make themselves felt in extreme degrees.

The subterranean and slightly elevated habitations generally suffer the influence of cold, increased still further by humidity. If we rise higher, we see the influence of the cold in winter become less sensible, but there is this result ordinarily, a greater and more fatal concentration of the air in the habitations; whilst, during summer, an excessive heat forces the inmates to seek for a renewing of the concentrated air by opening every issue to it.

Effects of unwholesome habitations.

The causes of insalubrity which are met with in the homes of the poor do not act with equal force on all ages.

One cause of this inequality of influence is the length of time passed in the abode; but there is another quite as important, it is the inequality in the force of resistance in individuals of different ages.

Infancy and old age are the ages the most exposed to feel the evil effects of insalubrious habitations, on account of the longer time passed in them; and it is also at these two epochs of life that we find an equal impotence to resist the enervating influence of the preceding causes, on account of the weakness of organization on the one part, and of the exhaustion of our organs on the other.

The adult resists better the influence of these causes, because his absences for his work allows him to feel their attacks less, and the energy of action with which his organs are endowed permit him to struggle against them with advantage. But the adult female, who possesses also this force of resistance, often struggles successfully against the influence of insalubrious habitations; however, as this cause acts more on her than on the adult man, she succumbs less often than the child and the aged, but more frequently than the adult male.

We will now consider the effects of the respiration of an impure air on the inhabitants of the dwellings of the poor.

The different causes of the vitiation of air above described act always either by decomposing the respirable air, so as to leave only products unfit for the support of life, or by adding to the air gases which mix with it, and which, introduced into the respiratory ducts, become noxious to life there. Sometimes, in consequence of the unequal weight of the gases mixed with the air, a displacement ensues; a gaseous product, unfit for respiration, takes the place of the air, and gives rise, in those who absorb it, to phenomena analogous to those which produce a commencement of asphyxia. Such is the action of carbonic acid gas when found in any notable quantity.

Lastly, at other times, the gases mixed with the atmosphere exercise a double action on it; one portion of these gases is employed in decomposing the atmosphere, while the other portion remains mixed with it, and determines, in those who breathe it, a violent irritation.

Thus, we have an insufficient quantity of respirable air, and a mixture of gases unfit for respiration.

Such are the two conditions which give rise to the mischievous consequences described.

The most severe, although happily rare, accident that arises from the state of things above described is *asphyria*.

Another, much less rare, is to find in the dwellings of the poor, patients affected with diseases of the chest, and whose difficulty of breathing is still more considerably increased by the concentration and vitiation of the air that surrounds them, and I have no hesi-

mation in asserting that the death of these unfortunates is much more rapid, and takes place also by a kind of asphyxia.

There is another disease also very frequent amongst our artizans, and which renders them, before old age comes on, infirm and incapable of work ; I mean *asthma*. Certain sorts of work bring on this very painful and troublesome complaint more rapidly than others. Persons engaged in the earlier preparations of cotton are peculiarly liable thereto.

Many asthmatic patients die of asphyxia when seized with a paroxysm in their dwellings, at a moment when the air that surrounds them is more than usually vitiated or rarefied.

Diseases of all kinds attack the poor man the more rapidly that his dwelling presents more numerous conditions of insalubrity and infection ; as to the epidemic affections which visit us from time to time, it is now well-known that the parts of a town the most populous, the poorest and the most unwholesome, are those where these diseases find the greatest number of victims, where they, as it were, more specially take up their abode.

Man does not live wholly on bread, he lives also on air ; these are two aliments equally indispensable, and without which he cannot long sustain life. If the first can sometimes be waited for a short time, the other is incessantly and absolutely necessary, and if its absolute privation gives instantaneous death, dispensed with parsimony it produces effects so much the more pernicious as its quantity is less.

The habitual obscurity of the habitations of the poor is, besides, the cause of a great number of the maladies which so frequently attack infancy. It is to this cause particularly that is owing among poor children the predominance of the lymphatic temperament, the susceptibility of the mucous membranes to catarrhal affections, poverty of the blood, extreme flaccidity of the tissues, swellings, deviations of the osseous system, and as consequences of these different causes, the frequency of scrofulous diseases, scurvy and rickets.

All who are much in contact with the poor of our populous cities well know how frequent are these different diseases among the children.

Among all the maladies which attack the poorer classes in our large towns, consumption partakes with scrofula the sad privilege of seizing on a great number of victims.

REMEDIAL MEASURES.

Cellars.

All cellars situated in culs-de-sac, or in very narrow and infected streets or courts, should be discountenanced by authority.

Wherever possible, two openings should be made in opposite walls in every cellar, one of which may be the door, and this should be as large as possible.

Every cellar should be provided with a window to open as widely as possible.

The establishment of a chimney in all inhabited cellars should be rigorously prescribed.

The internal walls of all cellars should undergo frequent lime-washing.

Courts.

Whenever an opportunity presents these should be widened.

The open channels which so frequently traverse their centres should be abolished, and the drainage accomplished by means of subterranean pipes.

No accumulation of dung or ordure should be permitted.

Frequently washing with large quantities of water, the channels and surfaces of the courts, and the privies, imposing on the proprietors the necessary repairs of the house property from which they draw rent; and making proper regulations that houses in narrow courts shall not be built of too great a height: such are the most important points which more especially call for the directions of the authorities anxious for the health of the inhabitants of towns.

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REPORT

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IN FRANCE

REGULATION OF NOXIOUS TRADES
AND OCCUPATIONS;

DR. WALLER LEWIS,

MEDICAL OFFICER TO THE GENERAL POST OFFICE.

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